MECHANICAL HANDLING
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## THE MEN FOR THE JOB

WHY is the study of materials handling still so neglected in many factories? Usually, because nobody in authority has thought it worth while to appoint a man or establish a department to have overall responsibility for all materials handling activities throughout the organization.

At a guess, we would say that for every commercial or industrial firm having a vigorous and continuously developing handling policy, there are a dozen or more which have scarcely the haziest notion of the importance of the handling function from the viewpoint of time and cost.

To achieve the greatest success in combating materials handling costs, it is essential to have a defined and organized approach to the problem. This does not necessarily mean a large department staffed by numerous engineers. In a small firm it may be sufficient to make materials handling matters a part-time job for a keen junior executive. Enthusiasm, inventiveness, and willingness to make himself an expert in the subject are the main qualifications. But those in authority must see that he really does have sufficient time to study the problem effectively, and is not overburdened with other duties.

In the larger concern, it is true, it may be necessary to employ one or more whole-time materials handling specialists. The training required of such specialists is still the subject of controversy, but big steps have recently been taken by the Institute of Materials Handling towards establishing properly recognized qualifications for the handling engineer. It is announced that plans have now been prepared for admittance to membership of the Institute by examination, and (while the idea of examinations for their own sake should not be encouraged), this step should do much to increase the status of Institute members and indeed to spread the acceptance of materials handling as a subject worthy of special study. In addition, the Institution of Production Engineers announced some time ago the introduction of a syllabus for Factory Layout and Materials Handling to be included in their revised Associate Membership Examination, operative in 1960 and onwards.

These developments are welcome signs that materials handling is at last beginning to receive the attention it deserves. Analyses of costs are difficult to come by, but anyone still unconvinced of the benefits obtainable by specialist treatment of this subject, should be reminded of the American company which, after establishing a specialized handling department, made a saving of $72,958 a year in the handling of steel between steel mill and production departments. Similar examples could be found in every factory where an efficient handling engineer or department is at work.

One other point is worth mentioning. Full success cannot be achieved unless the co-operation of every man, woman and boy in the factory is enlisted. Workers should be made aware of the importance of reducing the amount of handling to the minimum, and interest in the subject can be stimulated by suggestion schemes carrying suitable rewards for proved results.

*Pour les lecteurs de l'étranger*
*Für unsere ausländischen Leser*
*Para los lectores de ultramar*

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# FLEXIBLE HANDLING FOR HIGH OUTPUT

## Quantity Production of Record Changers

## Facilitated by Dual-directional Handling Equipment

At the new Ripple Works of Collaro, Ltd., the well-known manufacturers of gramophone units, record changers, pick-ups and tape transcriptors, can be seen a striking example of the time- and space-saving advantages obtainable with modern conveying equipment as applied to large-scale repetitive manufacturing and assembling operations. One of this company's three main factory buildings at Barking, Essex, is almost exclusively devoted to the quantity production of Collaro four-speed gramophone record changers for home and overseas markets, and has an output capacity of up to 20,000 of these units per week. That this is achieved on a floor area of about 80,000 sq. ft. is mainly attributable to the use of the Teleflex chain conveyor designed and installed by Teleflex Products, Ltd., Basildon, Essex. Full advantage is taken of the adaptability of this feeding medium not only to conform to general layout requirements for maintaining a continuous and synchronized sequence of processes, but also to easy handling at changing levels of component parts of different sizes and weights in successive stages of production, assembly, inspection, testing, finishing, packing and final disposal.

At first sight the Collaro installation appears as a complicated system of runways above numerous parallel lines of benches extending across the full width of the factory floor, separated by access gangways and, where required, Fisher & Ludlow Flowline belt conveyors and work tables of slotted angle construction. The whole layout, however, is planned to make full use of the available floor space without obstructive congestion or confusion liable to retard the flow of work in progress.

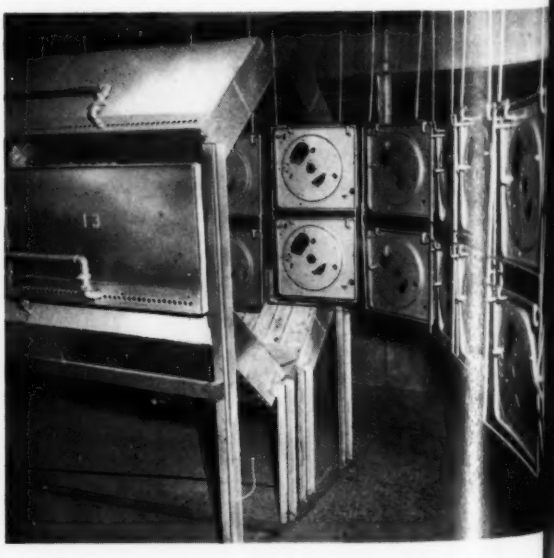
There are six entirely independent endless conveyors varying in length from 466 ft. to 750 ft., all of the dual-directional chain medium-duty type. This has an articulated drive chain, the twin link connections of which are each fitted with four steel rollers, two on vertical and two on horizontal axes and running on Oilite bushes and ball bearings respectively within a containing steel supporting track. The rollers on vertical axes guide the chain between vertical track facings, and those on horizontal axes run along horizontal tracks and carry the load. The track can be straight or curved vertically or horizontally to any radius down to a minimum of 2 ft. 6 in. to divert the feed at any angle to higher or lower levels or to change direction to right or left.

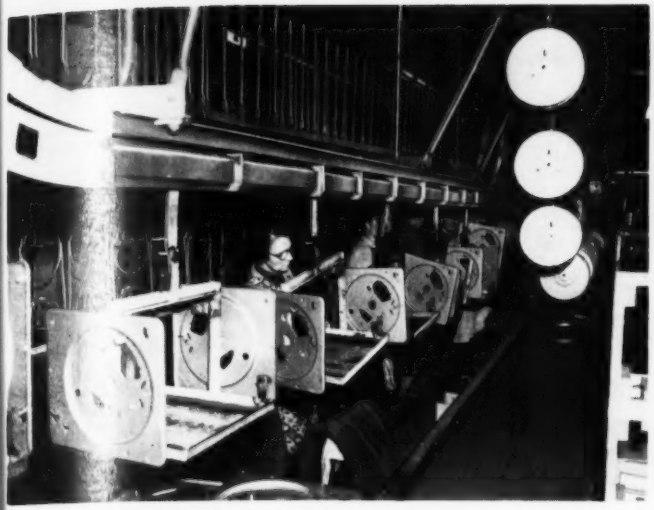
Each drive chain passes round an overhead sprocket wheel continuously driven by an electric motor through a belt and reduction gearbox mounted on an adjustable frame whereby correct tension is maintained. As a safeguard, the size of the sprocket driving pin is such that it shears should movement of the conveyor be accidentally arrested. Predetermined travelling speeds to meet requirements are obtained by selecting sprockets of suitable sizes.

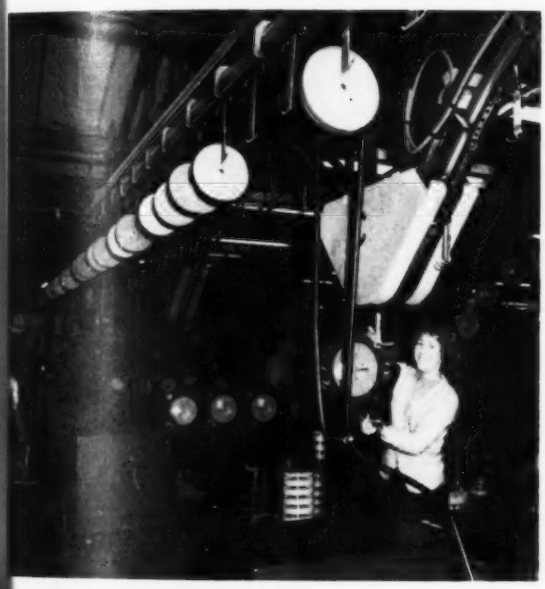
To comply with the planned sequence of operations, the conveyor tracks are supported at different levels, crossing and recrossing at numerous points and necessitating frequent

*Unpainted unit plates being fed to conveyor after inspection*

*Freshly painted unit plates and turntables leaving the stoving ovens before final lacquering*







ABOVE, LEFT:
*Turntables being conveyed to the finishing end of assembly lines, and cradles on which tested record changers are taken to the packers and unit plates are delivered to the assembly starting points*

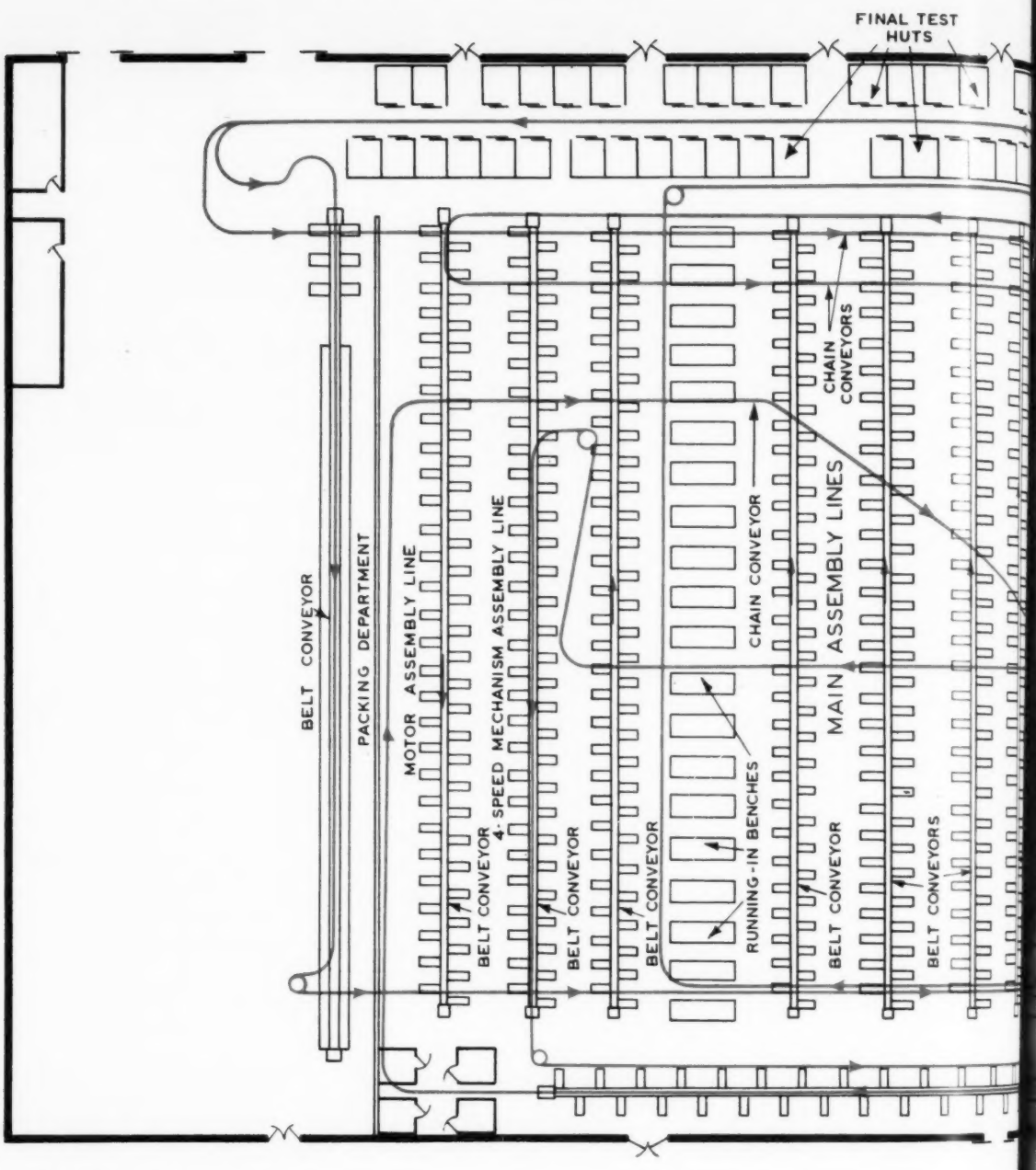
ABOVE, RIGHT:
*Turntables from the stores being fed to conveyor for transit to the assembly lines*

LEFT:
*Operator transferring finished record changers from the end of an assembly line to a conveyor for transit to the running-in racks. Two turntable conveyors are also shown, that on the right dipping down to the assembly lines*

BELOW, LEFT:
*Inspection stage on an assembly Flowline conveyor*

diversions at various angles in both vertical and horizontal planes. The articles conveyed are placed on hangers suspended from the chains and varying in length and form according to the designs or sizes of the parts or components carried to ensure security and ease of loading and unloading. The hangers are spaced at 8 in, the chain pitch, or at multiples of this, so that the loads are imposed directly under the rollers. To bring them within convenient reach of the workers, the tracks are either run straight at a suitable low height and parallel with the bench lines, or dipped down to each bench where they cross the lines at right-angles. So that assembly of the record changers is not affected by temporary failure in the supply of any of the component parts, the lengths of the conveyors are increased to provide live storage accommodation for a considerable number thereby held available to the workers while the normal supply is interrupted.

In some cases the conveyors are used for more than one purpose, either for the transit of two different components or for conveying one through two stages of production. Though their speeds are determined to feed according to the handling capacity of the operators concerned, some components may complete more than one circuit before being removed from the line for assembly. The whole production routine is in fact conducive to high output by the operatives, of which the majority are women, employed on an incentive basis. The parts for assembly are brought to them by hand trucks from adjoining factories where they are produced and stored. The entrance doors are opened automatically under photo-electric cell control as the trucks approach them and are similarly closed behind them so that the doors are not damaged by the trucks being pushed

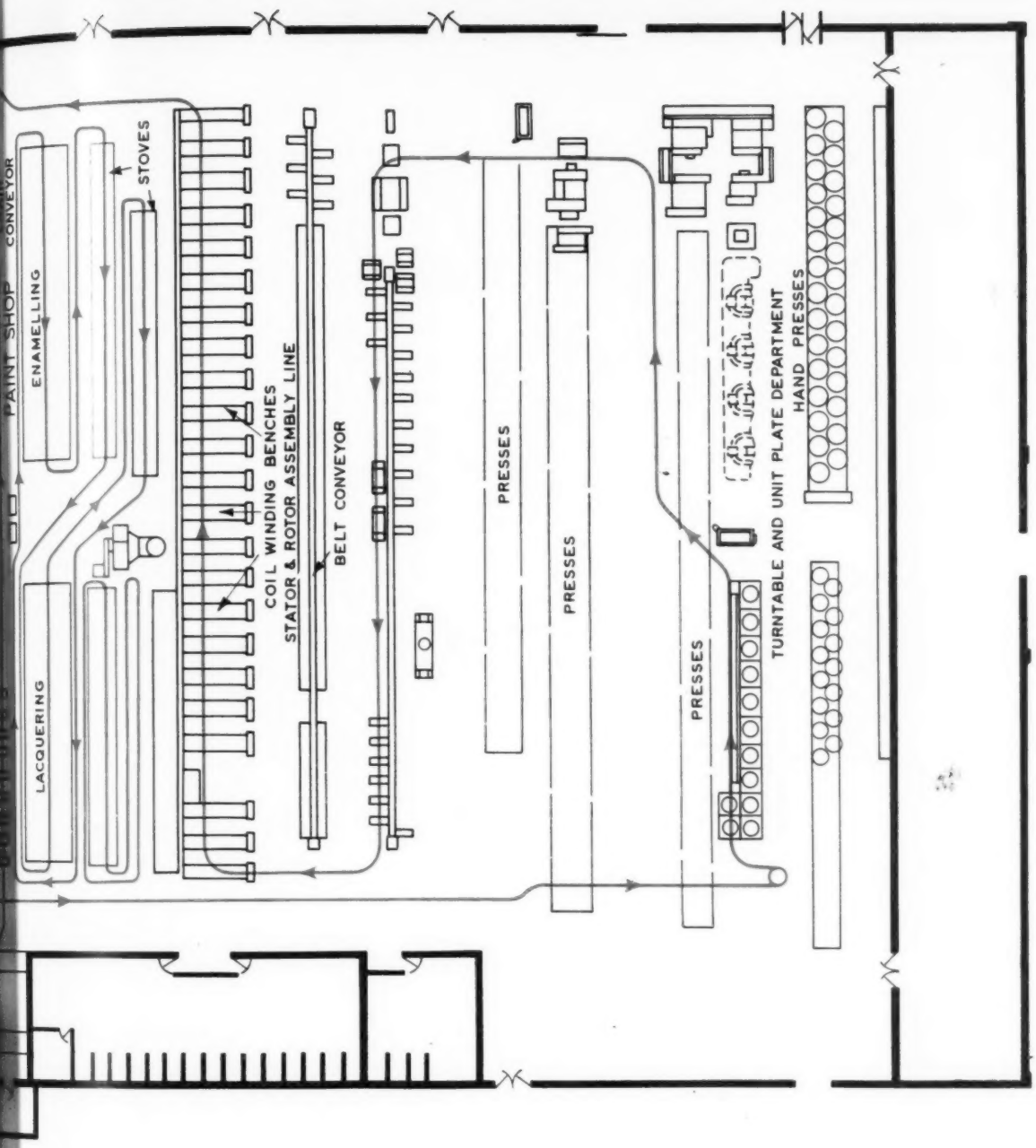



*Layout diagram showing conveyor routes*

against them, and delays in transit are to some extent reduced.

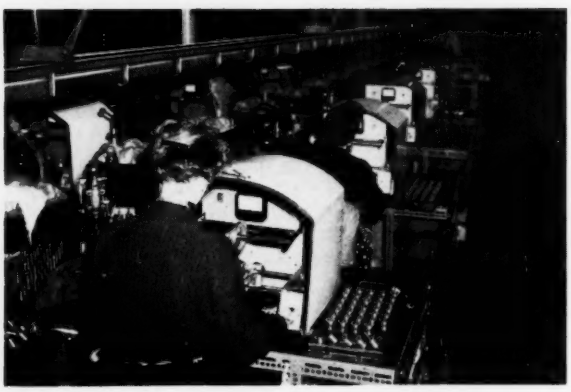
At one end of the factory are installed hydraulic and other machines for the production of the record changer unit plates from squares of sheet steel. These are first fed by hand to a hydraulic press that forms the turntable wells, and then to a hydraulic cutter for trimming the edges. A belt conveyor then takes them to the first of a row of machines for beading the edges, piercing holes and apertures, grinding to remove burrs and fitting bushes and pegs. They are also inspected for metal and other defects and finally placed on a conveyor, one of the longest, that takes them to the paint shop. Turntables are also taken to the paint shop by hand truck.

The very high standard of enamel finish obtained for the unit plates and turntables is achieved by subjecting them to the Ransburg 90,000-V electrostatic painting process—a technique whereby the paint is delivered by fast-rotating bells and atomized by the high voltage. The paint shop is enclosed and extends across the centre of the factory. One section of the shop is equipped with enamelling plant and infra-red gas stoving ovens for applying three primary coats to both sides of the plates and tables. In a separate section a finishing coat of lacquer is added. A separate




conveyor takes the components through these processes after being fed on to it by hand at one end. They are carried in pairs, one above the other, on specially designed jigs supported on long hangers from the conveyor chain. As the jigs shield small portions of their undersides, when they emerge from the primary coat ovens any unpainted areas are spray-painted by hand before they enter the lacquering section. Three paint colours, gold, cream and mushroom, are standardized, and when a change of colour is required, a plant stoppage of several hours is necessary while the painting equipment is cleaned.

Across the full width of the other half of the factory are installed seven lines of assembly benches with Fisholow belt conveyors alongside them for supplying certain parts to the workers, and separated by gangways. Five are used for the assembly of complete record changer units, and two at the far end are reserved respectively for the assembly of motors and motor 4-speed mechanisms. Adjoining the main assembly lines are two lines of benches equipped for running-in changers, and there are also benches on which the rotors are dynamically balanced. At the extreme far end and partitioned from the main area is the packing department where finished units are conveyed by belt and cartonned for despatch or storage. Down one side of the



ABOVE:
*Conveyor delivering assembled record changers to the running-in racks and thence to the test huts*

LEFT:
*Operator feeding run-in record changers on to conveyor for despatch to the final test huts*

BELOW, LEFT:
*Conveyor that takes finished motors to the assembly lines. In the foreground are seen operators dynamically balancing rotors*

factory and adjoining the delivery ends of the main assembly lines are 40 sound-proofed test huts in two rows with a gangway between them where finished changers are finally tested before release to the packing department.

Served by two conveyors outside the delivery end of the paint shop is a short line of benches where freshly painted turntables are completed ready for assembly by being drilled and fitted with central bushes and, if necessary, made to run true when rotating on a special corrective machine. They are then loaded on to one of the conveyors for transit to the ends of the main assembly lines for fitting. On the same conveyor are also placed, if required, finished turntables received by truck from the stores.

Painted unit plates, after inspection at the benches, are placed on the other conveyor and taken to the starting end of the main assembly lines after passing between the test huts and through the packing department. The plates are not carried directly on the hangers, but are hung on the two ends of cradles in which assembled changers are placed after final testing in the huts.

Completed but untested units are taken to the test huts by another conveyor running below that carrying the cradles and unit places. By this they are previously delivered to and re-collected from the running-in benches. As they are carried on simple double-hooked hangers, they are readily removed by the testers. All those found to be satisfactory

are placed by the testers on to the cradles suspended from the upper conveyor for delivery to the packers. Outside each test hut is an electric lamp which is switched on should a tester require the attendance of one of the chief inspectors on duty outside. All the record changers are assembled on special frames, and the unit plates are protected from damage by tight-fitting rubber covers. These are removed for re-use in the packing department and are then replaced on the same conveyor for return to the beginning of the assembly lines.

One of the conveyors is used exclusively for the handling of the record changer motors. It passes over the 4-speed mechanism assembly line and alongside that where the motors are completed for delivery about half-way along the main assembly lines which it crosses at right-angles. Previously, this conveyor was used to take the 4-speed mechanism through a special assembly shop extending about half-way down the side of the factory adjoining the ends of the main assembly lines. It traverses in both directions through this shop where it now serves to add to the conveyor's storage capacity.

The stators and rotors of the record changers are assembled on a Fishoiow belt conveyor adjacent to a line of benches confined to coil winding operations. These units are not carried by a chain conveyor but are palletized and taken by hand truck to the main assembly lines.

*Two conveyors running between the test huts. The lower one delivers untested units to the huts and the upper one tested units to the packers and painted unit plates to the assembly lines*

*Conveyor bringing finally tested units to the packing Flowline and taking cradles with unit plates and assembly frames to the assembly lines. In the foreground are operators carrying out 'Wow and Flutter' tests*

BELOW:
*Tight turn in conveyor as it leaves the packing department with unit plates and assembly frames as well as finished record changers not previously removed from the cradles*

BELOW:
*End of packing Flowline under conveyor taking painted unit plates and assembly frames to start of assembly lines*

BELOW:
*Conveyor delivering unit plates and returning assembly frames to the start of one of the assembly lines*

# BULK CEMENT HANDLING PLANT

*Opening of New Installation at Turners Asbestos Cement Co., Ltd.*

A NEW bulk cement handling plant was opened recently at the Erith works of Turners Asbestos Cement Co., Ltd., by Mr. K. Neve, executive director. Mr. Neve formally set the installation in operation by pressing a switch on its control panel.

This is the latest addition to Turners Asbestos Cement Co., Ltd., facilities for the bulk handling of cement in their different works, and, in this case, the cement is delivered by barge.

**Description of the New Plant**

The installation has been erected on the west side of the Erith works' wharf, known as Anchor Bay. The unloading plant consists of a counterbalanced bucket elevator suspended from an 'A' frame structure so that its height can be regulated to suit the variations in tide and draught. This elevator discharges into a screw conveyor fixed at one end and arranged to move in conjunction with the movements of the bucket elevator at the other. Cement is then passed through a second fixed screw conveyor which delivers the cement to a surge hopper arranged over a Fuller Kinyon cement pump. This pump and ancillary equipment, as well as the main control desk and the plant required for supplying barges with power and compressed air, is housed in a building adjacent to the unloader structure, and is arranged to discharge cement through a pipeline made from T.A.C. asbestos-cement pressure pipes and electrically operated, remotely controlled valves to the machine silos. The control desk is arranged on the mimic diagram principle, so that the flow lines in use and the extent to which the silos are charged can be seen at a glance.

The barges in use have a maximum capacity of about 350 tons and the plant has been designed to handle this quantity into the storage silos well within one tide, enabling a rapid turn-round of barges to be effected.

The layout has been arranged to allow for the installation of a second unloading plant at a later date, which would enable two barges to discharge simultaneously.

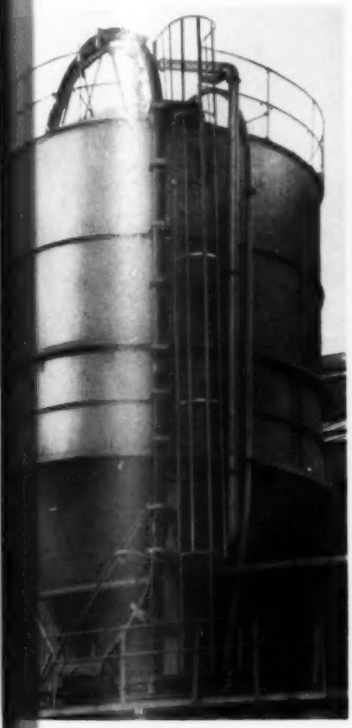
Each of the four asbestos-cement making machines in the North Factory is arranged with its own 300-ton storage silo

LEFT:
*Fig. 1. Barge unloader at work. This is part of the new bulk cement handling plant recently opened at the Erith works of Turners Asbestos Cement Co., Ltd.*

BELOW:
*Fig. 2. View from end of dock*

RIGHT:
*Fig. 3. Cement storage silos*

BELOW:
*Fig. 4. Close-up of a silo showing asbestos-cement filling line*



which gives sufficient reserve of cement to guard against delivery hold-ups due to unusual weather conditions. The silos are also arranged so that they can, if necessary, be filled from or discharged into road tankers.

When required, the cement is automatically withdrawn from the base of the silos, conveyed to weighers and batched into the process as required.

To allow the cement barges to be manœuvred into the Anchor Bay wharf at the required states of tide it was necessary to deepen it by approximately 4 ft and this entailed reconstructing the walls on its three sides.

The erection of the Erith installations has been controlled by T.A.C.'s London architects, Elliott, Cox & Partners, the main building contractor being H. Friday & Sons, Ltd., of Erith. Underground work, dredging and piling was carried out by John Shelbourne & Co., Ltd., and Blaw Knox, Ltd., were the main contractors for the supply and installation of the handling plant.

**How This Development Arose**

Turners Asbestos Cement Co., Ltd., have had extensive experience of bulk handling of cement. The first bulk deliveries were made to their Dalmuir works in May, 1954, and after the equipment had been proved it was decided to go ahead with the erection of a similar installation at Widnes, but taking delivery in rail wagons. In March, 1955, the erection of a bulk cement handling plant in the South Factory at Erith was completed. A fleet of bulk road container vehicles is employed to keep the silos full.

The cement used in the North Factory was previously delivered in 2-cwt sacks from The Cement Marketing Co.'s Wouldham works on the north side of the Thames, being transported by barge. Steam cranes on the river front lifted these sacks on to mobile trucks which transported the cement to a store from which it was manually handled, as required, into the conveying systems supplying the asbestos-cement-making machines.

By this time, Turners Asbestos Cement Co., Ltd., have acquired considerable experience in taking cement in bulk by road and rail. However, for the North Factory at Erith, which has its own Thames-side wharf, they agreed with The Cement Marketing Co. that if suitable equipment could be installed for handling cement from barges fitted with 'Airslides' and scraper elevators, developed for their own use at Hurlington, cement could still be supplied by their Wouldham works.

**Why this Progress is Necessary**

In the manufacture of asbestos-cement products by Turners Asbestos Cement Co., Ltd., cement is the raw material which is used in far greater quantity than any other. Many thousands of tons are involved and these create their own

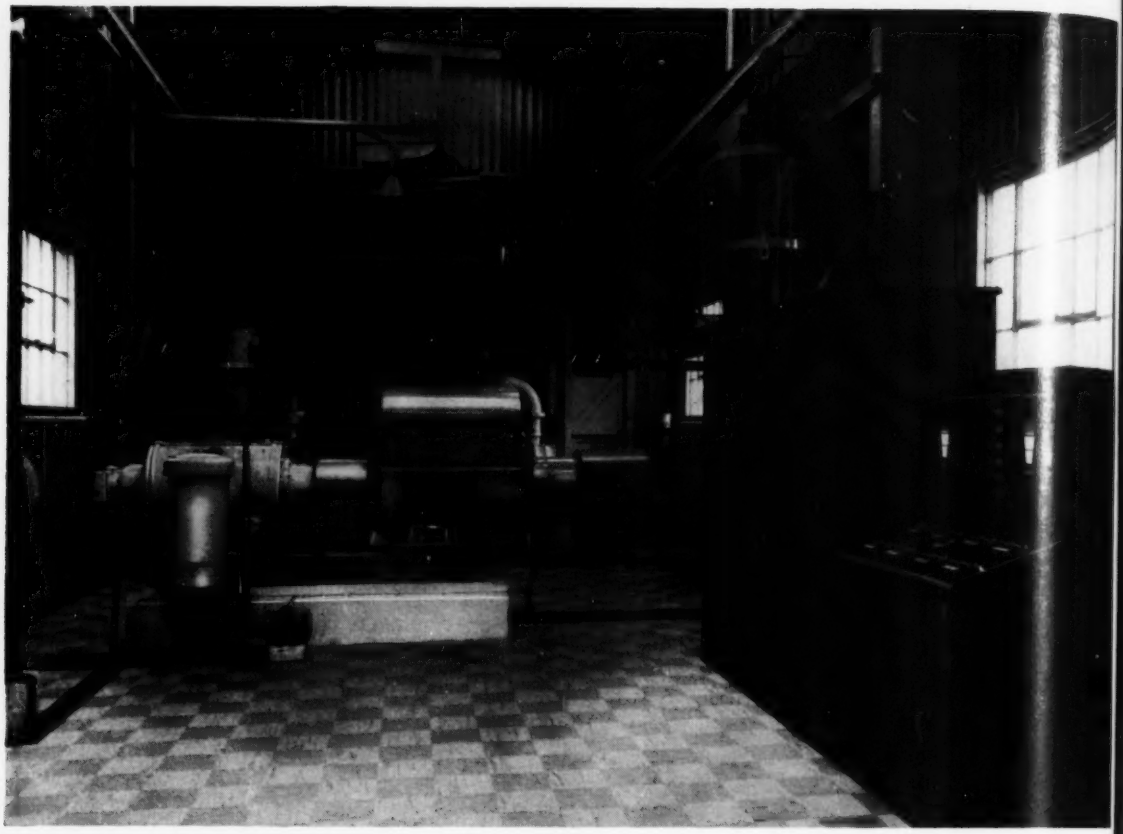


*Fig. 5 (above). Cement distributing plant and control panel*
*Fig. 6. Close-up of control panel showing mimic diagram*

peculiar delivery and storage problems.

For many years cement was delivered firstly in jute bags, which had to be returned and kept in repair, and later in non-returnable paper sacks, but it was not always easy to dispose of these. The bags, which in the case of T.A.C. Co., Ltd., contained 2 cwt of cement, had to be handled from the transport vehicle, be it motor vehicle, rail wagon or barge, stacked in the warehouse, and then on to the conveying system feeding the raw materials to the asbestos-cement-making machines.

It had been realized that the delivery of cement in bulk would provide economies in prime cost and time and would give great advantages of cleanliness in the areas concerned.

Bulk delivery was what many users wanted and it had long been possible to get cement delivered in tipping wagons. However, discharging was a very dusty process, and dangerous in terms of health to the operatives, and Turners Asbestos Cement Co., Ltd., were not prepared to accept such an arrangement. It was known, however, that cement, when aerated, would flow almost like water: pumping equipment was also available which would blow it for long distances. All that was needed was pressurized road or rail containers to deliver cement to the factory and T.A.C. Co., Ltd., could make the necessary mechanical arrangements to take over from there.

About 10 years ago, officials from G. & T. Earle, Ltd., who supply the cement to the T.A.C. factories at Trafford Park and Widnes, the British Transport Commission and the T.A.C. engineering department together sought a solution, and after several years a suitable railway wagon for carrying cement in bulk was evolved. This type of container is now used for the conveyance in bulk of a wide variety of powders, in addition to cement.

Meanwhile, cement manufacturers were designing road vehicles and early in the 1950s it was found possible to get delivery of cement in bulk pressurized vehicles at the T.A.C. factory at Dalmuir near Glasgow. Designs had already been approved for the installation of plant for the handling of cement in bulk at that factory and a contract to erect this was placed with Blaw Knox, Ltd., whose engineers worked very closely with T.A.C. engineers in the development stages.

# TROUBLES ON POLYPHASE MOTOR CIRCUITS

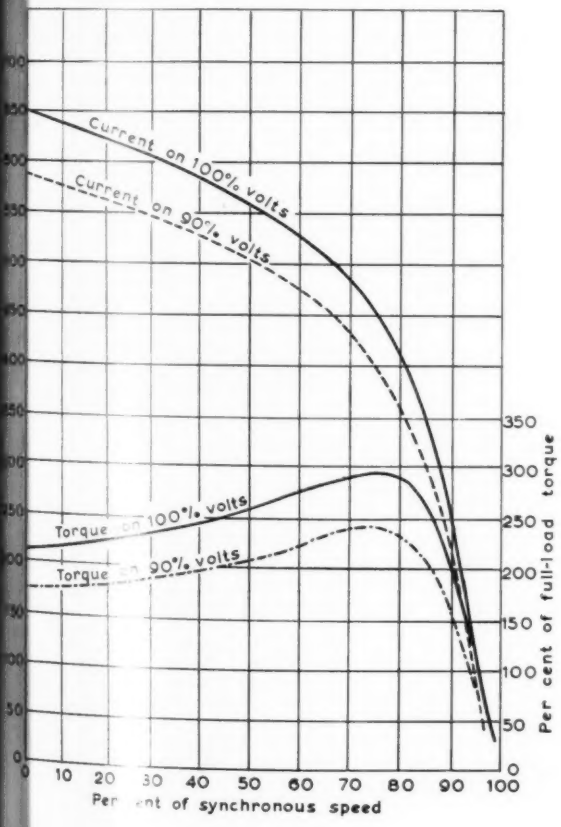
By J. L. WATTS, A.M.I.E.E., A.M.C.T.

MANY TROUBLES which occur on motor circuits are due to fairly simple causes which can be easily rectified, whilst others necessitate extensive repairs. When a motor fails to function properly after a period of satisfactory use the cause should be located and put right as soon as possible to limit the damage.

**Operation of Fuses or Overload Trips at Starting**

If the fuses or overload trips stop the motor as soon as it is switched on the defect may possibly lie in the fuses or the overload trips themselves. It may be that the motor is taking a high current due to it remaining stalled or starting slowly, due to overload or low voltage. An open circuit in the stator circuit, an earth fault or short circuit in the stator circuit, or in the rotor circuit of a slip-ring motor, may also cause the fuses to melt or the overload trips to release the starter.

*Fig. 1. Characteristics of a typical single-cage, 3-phase squirrel-cage induction motor*




**Fuses and Overload Trips**

Fuses may melt due to them being too small, whilst it sometimes happens that the fusible element melts prematurely due to overheating caused by a faulty contact or connection at the fuse. These points should be checked. Table 1 gives suitable sizes of fuses.

Magnetic overload trips may trip prematurely if set at too low a current value. In general the trips should be set to operate in the event of sustained current 25 per cent above the full-load current of the protected motor. Such trips may operate if the time-lag dashpots are short of oil, or if the oil is too thin or dirty. If necessary it is preferable to increase the time lag rather than increase the current setting. A thermal overload trip may operate prematurely if fitted in a hot position, due to heating of the element caused by a faulty connection, or due to the trips being set at too low a current value.

**Table 1 Suggested sizes of fuses for 415-volt three-phase motors**

| Rated horse power | Approx. full-load current. (amps) | Direct-on-line starting | | Star-delta or resistance starting | |
|---|---|---|---|---|---|
| | | Rating of cartridge fuse (amps) | No. and size of tinned-copper fuse wire (s.w.g.) | Rating of cartridge fuse. (amps) | No. and size of tinned-copper fuse wire (s.w.g.) |
| 1 | 1·7 | 6 | $\frac{1}{36}$ | 6 | $\frac{1}{36}$ |
| 3 | 4·8 | 15 | $\frac{1}{26}$ | 6 | $\frac{1}{32}$ |
| 5 | 7 | 20 | $\frac{1}{24}$ | 15 | $\frac{1}{24}$ |
| 7·5 | 10·5 | 30 | $\frac{1}{21}$ | 20 | $\frac{1}{21}$ |
| 10 | 13·5 | 35 | $\frac{1}{19}$ | 25 | $\frac{1}{20}$ |
| 20 | 26 | 80 | $\frac{1}{16}$ | 50 | $\frac{1}{16}$ |
| 30 | 39 | 100 | $\frac{1}{14}$ | 60 | $\frac{1}{17}$ |
| 40 | 52 | 160 | $\frac{2}{16}$ | 80 | $\frac{1}{15}$ |
| 50 | 64 | 160 | $\frac{2}{15}$ | 100 | $\frac{1}{14}$ |
| 75 | 95 | 250 | — | 160 | $\frac{2}{15}$ |

**Stalling and Overload**

As may be seen from Fig. 1 the stator current of an induction motor falls as the motor accelerates from rest. If the motor remains stalled when switched on, however, the initial high value of current will continue to flow, and the overload trips may then function or the fuses melt.

Overload may cause a running motor to overheat and the overload trips to stop the motor, if correctly set. It may also prevent a motor starting, or may cause it to start up slowly so that the duration of the high starting current is increased, and the fuses or overload trips may operate.

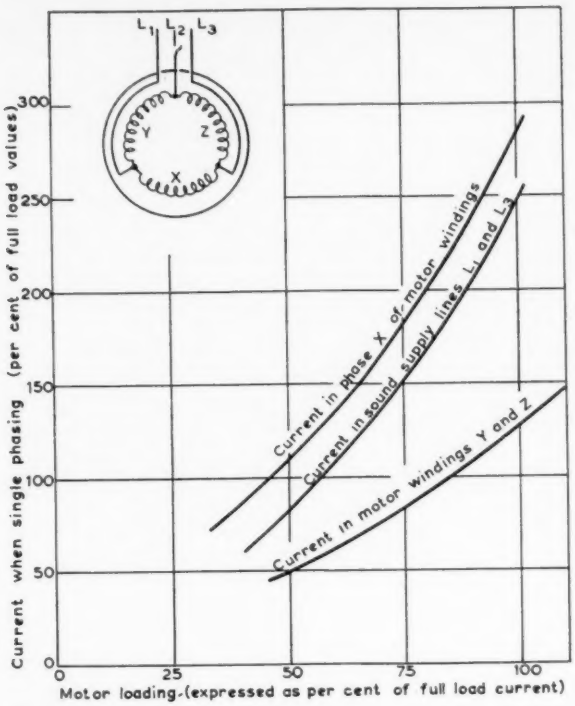



*Fig. 2. Effect of an open-circuited supply line to a 3-phase delta-connected induction motor*

Overload may be caused by the rotor rubbing on the stator due to worn bearings, bent shaft, rotor loose on the spider or shaft; tight bearing, the motor being too small, no-release of a brake, jamming or incorrect operation of driven plant, use of driven plant on increased load, speed or feed, blunt cutting tools, tight belts, motor out of line, non-operation of relief valves, etc. Overload when running causes increased current in each phase.

**Low Voltage**

The starting torque of an induction motor is approximately proportional to the square of the voltage applied to its stator terminals, thus faulty starting may be due to low voltage, as shown in Fig. 1. Low voltage may result from a supply fault, or excess volt drop on the motor-circuit cables owing to them being too small. The latter fault would be indicated if the voltage at the line terminals of the starter, with the starter 'off' is much higher than that at the motor terminals when switched on. Low voltage also results in a running motor taking an increased, and approximately equal, current in each phase when running on load, and may cause overheating of the motor.

**Open Circuits**

In the event of an open circuit in one phase of the supply to a motor, or in one phase of star-connected stator windings, the motor will hum when switched on, but will not be self-starting, although it will usually run in whichever direction it is started by hand. An open circuit in one phase of a delta-connected stator winding may allow the motor to start. In any case it is possible that the fuses may melt or the overload trips operate.

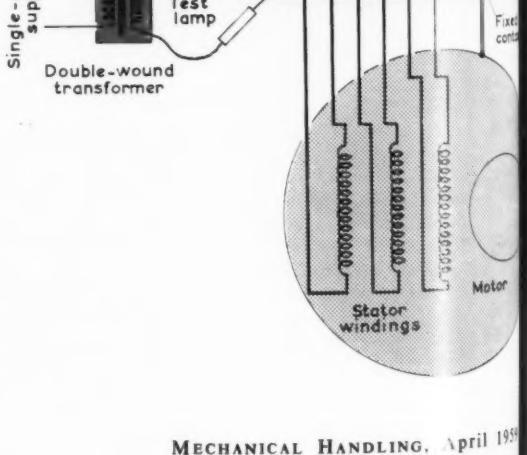
If such an open circuit occurs whilst the motor is running the motor may overheat if fully loaded, and the trips may then switch off the starter. However, as seen from Fig. 2, one phase of the stator windings of a delta-connected motor might be seriously overloaded without the current in the two sound lines reaching tripping value should one line become open circuited. The current in each phase of the supply to the motor will be unequal, with almost equal voltages between the phases, in the event of an open circuit in the stator circuit of a polyphase circuit. A 'tong-test' ammeter is very useful for comparing the line currents.

An open circuit may result from one fuse having melted, a broken or loose connection, or a contact having become worn or burnt or having inadequate pressure. One fuse may melt if this is smaller than that fitted in the other two poles. It is important that the fuses used to protect a 3-phase motor should be the same size in each pole.

Incidentally, some unbalance of stator currents may also be due to unequal voltages between pairs of stator terminals, as may occur due to unbalanced single-phase loads being connected between the phases and neutral, a high resistance connection in one phase, or an open circuit in one supply line to a motor circuit on which another motor, or motors, is running. Unequal stator currents with equal voltages may also indicate an earth fault or short circuit on the stator windings.

One or more open circuits in the rotor circuit of a 3-phase slip-ring motor may prevent the motor starting, or cause it to start slowly. The stator current will then fluctuate periodically when the motor is running. Such an open circuit may be due to a faulty contact, resistor or connection in the rotor circuit, a rough slip ring, brush not making contact with its slip ring or similar cause. Such a fault would be indicated by unequal currents in each of the cables between the brushes and rotor starter when the motor is running with the rotor starter in the running position and the slip-ring short-circuiting gear (if fitted) out in the starting position.; and by unequal resistance between slip rings measured with the motor at rest and the brushes raised from the slip rings with the slip-ring short-circuiting gear in the starting position.

*Fig. 3. Method of testing for an earth fault on a motor circuit*



**Earth Faults**

An earth fault is caused by failure of the insulation between a conductor and the earthed metal casing or sheathing. This fault causes unequal line currents with approximately equal voltages. It can be detected, after isolating the starter and holding the starter 'on', by applying a test-lamp circuit between one of the starter terminals and the metal case. Fig. 3 shows a test lamp, fed through a double-wound transformer, being applied to the stator circuit of a motor having a star-delta starter. The test lamp lights if an earth fault exists.

Similar tests may be made on the rotor circuit of a slip-ring motor after making sure that the slip-ring short-circuiting gear (if fitted) is in the starting position. It may, however, be necessary also to put the rotor starter in the starting position or to disconnect any permanent earthing connection which may exist on the rotor circuit.

**Short Circuits**

A short circuit is caused by the failure of insulation between conductors at different voltages. It results in overheating of the short-circuited section and is often accompanied by a smell of burning and the emission of smoke as the insulation burns. Generally the overload trips or fuses operate. A short circuit on the stator of a polyphase motor causes unequal currents in the supply lines to the motor, with approximately equal voltages; and may be indicated by unequal resistance of the phases of the motor windings measured when the motor is at rest.

The overload trips or fuses may operate if an attempt is made to start a slip-ring motor with the rotor windings short circuited. This may occur if the slip-ring short-circuiting gear, or the rotor starter, is in the running position at starting; although, in most cases, interlocks are provided to safeguard against this possibility. A short circuit in the rotor circuit may also occur if the insulation fails, as may be indicated by unequal resistance between the slip rings when measured with the motor at rest, the brushes raised from the slip rings, and the slip-ring short-circuiting gear (if fitted) in the starting position. A short circuit in the rotor windings of a slip-ring motor may also be indicated if the motor starts up when the stator windings are energized with the brushes raised from the slip rings and the slip-ring short-circuiting gear in the starting position.

**Control Gear Faults**

The starting of many motors is initiated by pressure on a push button or by the closing of an auxiliary switch in response to some physical change, this operation energizing an electromagnet to close the starting contacts.

The motor may remain quite silent and 'dead' when the auxiliary switch is closed if the electromagnet or its circuit is faulty, whilst the motor may fail to accelerate properly if there are faults in the control circuit. The starting electromagnet may be a solenoid which operates the main starting contacts directly, and possibly accelerating contacts also, or may operate auxiliary contacts which control the current through starting contactors. Such electromagnets automatically function as an under-voltage release, since they release the contacts if the supply is cut off. In a hand-operated starter a separate under-voltage release electromagnet is usually provided to control a hold-on catch.

In the event of a coil-operated starter failing to start a motor from rest when the auxiliary switch is closed and the supply is available on all phases at the starter, the first useful step in locating the cause is to ascertain whether the fault lies in the operating coil circuit or otherwise. This may be done by opening the starter, if necessary uncoupling the mechanical interlock so that the isolating switch can be closed, and closing the first (starting) set of contacts by means of a stick of insulating material. If the motor then starts satisfactorily a fault in the operating coil circuit is indicated. This might be due to low voltage, open circuit, earth fault or short circuit. If the motor fails to start, however, a fault in the main circuit of the motor or starter may be looked for.

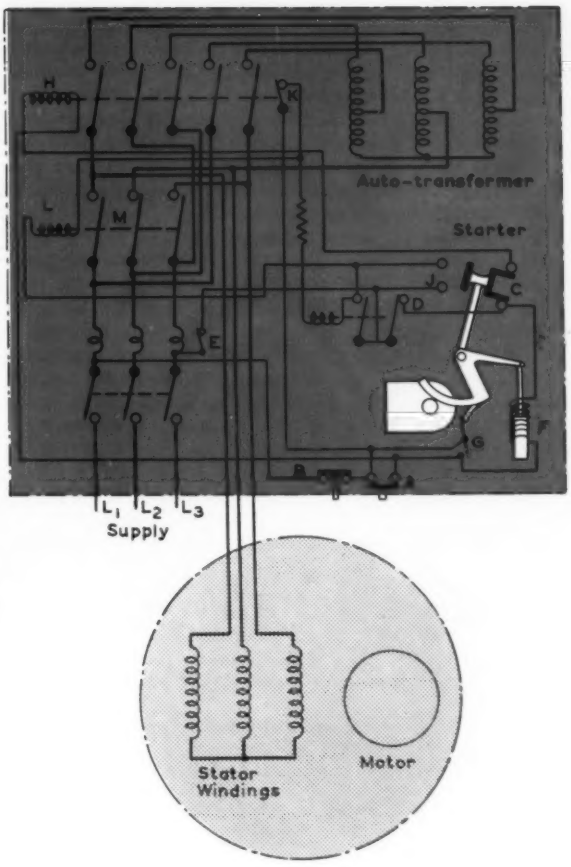



*Fig. 4. Connections of a contactor-type auto-transformer starter for a 3-phase motor*

**Control Gear Coil Circuit Faults**

Similarly if a hand-operated starter trips out a check may be necessary to find whether this is due to the under-voltage release or the overload trips, by temporarily holding the under-voltage plunger or armature in the running position with the starter on and observing the overload trips. The under-voltage release may fail to hold a starter in the running position, or a coil may fail to operate contacts, if the voltage is low, the coil is burnt out or open circuited, or there is an interruption in the coil circuit.

A burnt-out coil will usually be obvious and the insulation of the coil is likely to be discoloured and brittle. The coil may be open circuited, as may be indicated by attempting to measure its resistance after disconnecting one end of the coil from other parts of the circuit. When in doubt a new coil is advisable.

If there is an interruption of the supply to the coil the electromagnet will have no pull and there will be no voltage across the coil. Possible causes are the melting of a control circuit fuse, faulty contact at an isolating switch, overload trip contact, thermal trip contact, stop button switch,

auxiliary contacts in the starter or on slip-ring short-circuiting gear, interlock, timing or sequence contacts, or a loose or broken connection. These should be inspected and, if necessary, tested. A simple test may be made by connecting a test lamp, or two lamps in series, across contacts or parts which are suspected of being open circuited. If the coil circuit is otherwise intact the test lamp, or lamps, will light when connected across the open circuited part and/or the coil will operate or attempt to do so. Faulty contacts may be burnt or sticking.

For example the motor indicated in Fig. 4, would fail to start in the event of an open circuit at the starting push-button switch A, the stop push-button switch B, the contacts C on the timing relay, contacts D on the auxiliary relay, or the overload trip contacts E; since the coil H would not then be energized to close the starting contacts which connect the supply to the stator windings through the auto-transformer. If the hold-on contacts G were faulty and the others were in order the coil H would be de-energized as soon as the start push button A was released.

An under-voltage release coil may fail to hold a starter in the running position if the coil magnetism is weak due to low voltage; or a defect in its magnetic circuit such as the fixed core of a solenoid coming adrift and resting on the plunger, or being too short so that the plunger is not drawn right up to the fixed core. If the copper shading band, which encircles part of the pole face of an electromagnet, is fractured the coil will chatter considerably and is likely to release the starter. Mechanical causes, such as incorrect spring pressure or tension, loose or bent parts, sticking or worn catches, sticking armature or plunger, or vibration may also cause the starter to be released prematurely.

If a coil-operated starter starts a motor from rest but fails to run the motor up to speed the cause might be low voltage, overload or other main-circuit fault, but a fault in the coil circuit of the accelerating contactor should first be looked for on the lines described above. Faulty contacts at J or K in Fig. 4, would prevent the coil L of the direct-on-line contactor being energised to close the second-stage contactor M.

**Overheating of a Motor or Starter**

Overheating of a motor may be due to overload, earth fault, short circuit, or an open circuit in the main stator or rotor circuit. Overheating of a motor with equal and normal currents in each stator phase may result from the starting operation not being completed, the motor being in a hot position or not being properly ventilated due to an accumulation of foreign matter on the machine or similar cause. All motors and starters should be kept clean and well ventilated. Local overheating may be due to a faulty connection in a motor or its control gear.

**Reduced Motor Speed**

This may be due to overload, low voltage, low frequency, or the starting operation not being completed; whilst reduced speed of a slip-ring motor may result from the cables between the brushes and the rotor starter being too small, or slip-ring short-circuiting gear not being operated after the motor has been run up to speed by the rotor starter.

# MECHANICAL HANDLING ENGINEERS' ASSOCIATION

## Executive Committee

THE 20th Annual General Meeting of the above Association was held recently in London, and W. G. Picton (International Combustion Products, Ltd.) was appointed President of the Association and W. Morland Fox (W. J. Jenkins, Ltd.) Vice-President.

D. Cherry Paterson and H. F. Shields tendered their resignations from the Committee, but in view of their considerable and valuable contributions to the activities of the Association, they have both had conferred on them the status of Honorary Members of the Association. L. A. Collis (J. Collis & Sons, Ltd.) and F. S. Stent (Babcock & Wilcox, Ltd.) have been elected to the Executive Committee in succession to Messrs. Paterson and Shields.

Due to the death of T. A. Hammersley (reported in a recent issue of *Mechanical Handling*) a further vacancy has occurred on the Executive Committee and an election for the vacancy in question will take place.

The composition of the Executive Committee is now as follows:—

*W. Picton*

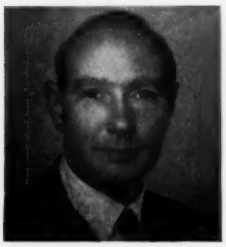
*W. Morland Fox*

*J. F. R. Mitchell*

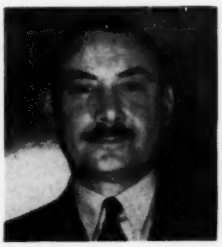
*D. Jackson*

*B. C. Morton*

*I. Hey*



*H. G. Harwood*



*L. Brook*

*L. A. Collis*

*F. S. Stent*

K. MUMBY

# RAISING STICKY MOULDING SAND TO SERVICE HOPPERS

*An all-steel curved-pan conveyor, rising steeply from a horizontal intake in the foundry producing Britain's biggest output of hematite iron castings, has provided a new solution to a well-known handling problem*

IN THE ingot-mould foundry of the Distington Engineering Co., Ltd., Workington, Cumberland, an interesting method is being used for the difficult operation of transferring sticky moulding sand from the underfloor section of the distribution system to the overhead conveyors feeding the service hoppers. Normal methods having proved unsatisfactory, the company's works engineer found the answer to a foundryman's familiar problem by installing a W.S.13 curved-pan conveyor in place of the existing bucket elevator.

Distington is a subsidiary of The United Steel Companies, Ltd., and one of the biggest producers of medium and heavy iron castings in the country, with an output of up to 2,000 tons/week. In addition, it manufactures a variety of plant for the mining and heavy engineering industries in Great Britain and overseas, including the Distington-Goodman range of duckbill loaders, tunnellers, shaker-conveyors and recently developed rope-belt conveyors.

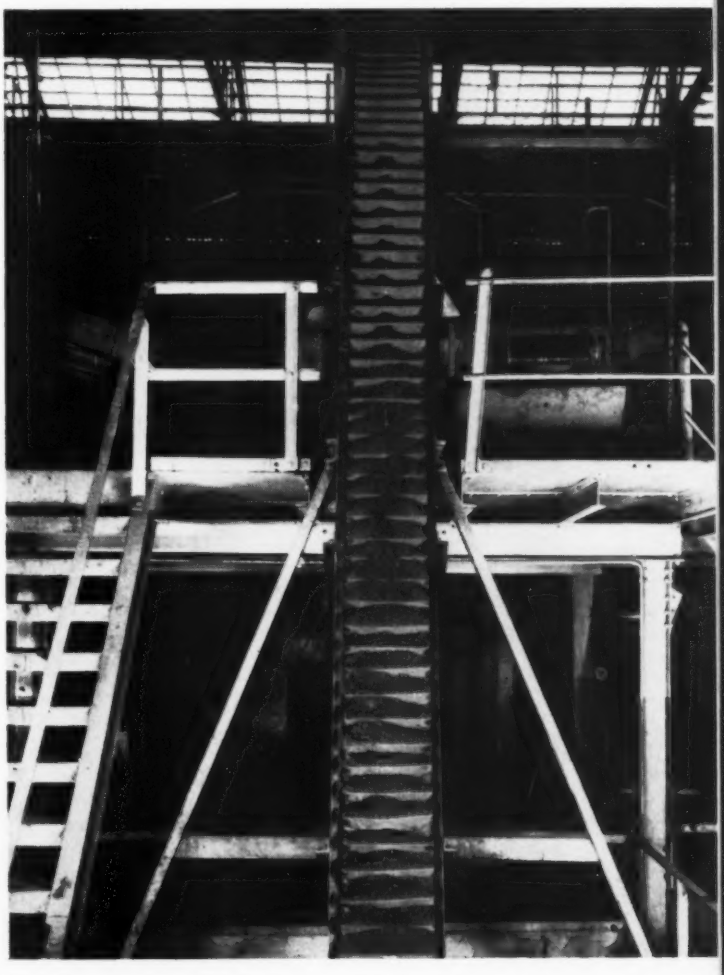
In 1945 the works was initially equipped by United Steel for the manufacture of mine cars and ingot moulds. Rapid expansion has brought it to its present status as one of the biggest foundries in Europe, in terms of output.

**Ingot-mould Production**

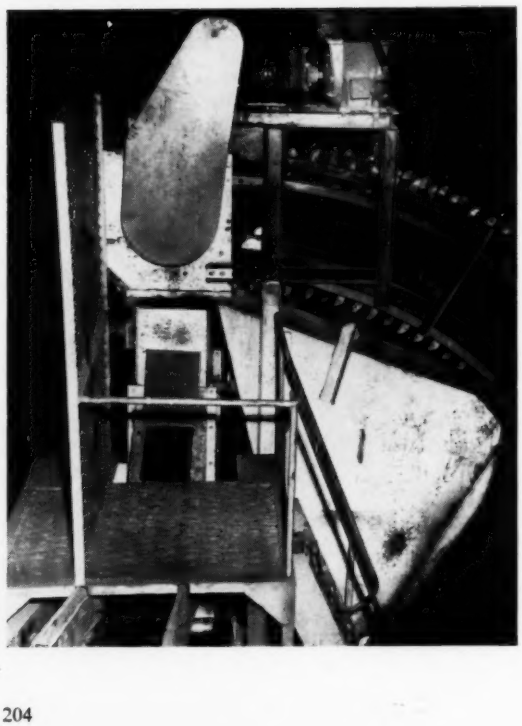
Ingot moulds and bottom plates, and also slag ladles and miscellaneous items of equipment for associated companies in United Steels and for general engineering purposes, are cast in a 7¼-acre foundry that was laid out originally for the production of 1,000 tons of finished castings a week.

BELOW
*Fig. 1. Intake end of W.S.13 conveyor at Distington foundry. Moulding sand conveyed below floor-level from preparation and mixing plant is fed directly on to the curved pans*

RIGHT
*Fig. 2. Sand carried upward on flights of all-steel conveyor at a speed of 130 ft/min. When fully laden, the equipment handles 75 tons/hr*



LEFT
*Fig. 3. The conveyor is inclined at an angle of 69 deg and climbs to a height of 25 ft*



BELOW
*Fig. 4. Sand discharged through hopper to overhead belt conveyor serving a line of bunkers. As the photograph shows, spillage is negligible*

This output has been doubled by expanding and reorganizing the foundry equipment and improving the production methods, and developments are under way for bringing in further improvements.

Special qualities of haematite irons are used for the ingot moulds. Machine-cast pig is supplied from the neighbouring works of the Workington Iron & Steel Co., another member of The United Steel Companies, and the moulds themselves are distributed to steel-making organizations within the group.

Full advantage has been taken of the opportunities afforded by the interrelated ironfounding and steel-making functions of the associated companies to collect and interpret operational data for research, with the result that production methods and product control have been brought to an impressively high level of efficiency.

Advanced statistical methods are used to correlate the life of the ingot moulds produced at Distington with the methods and materials used for their production, both of which are held under very close control.

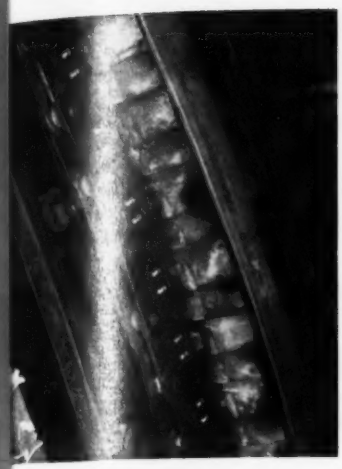
Throughout the works there is evidence of a high regard for mechanization in the handling of materials, and of an enterprising use of original methods to improve upon orthodox techniques. The installation of a curved-pan conveyor to elevate moulding sand is but one example of such initiative; equally interesting new developments are in progress at other stages of manufacture.

**Sand-preparation System**

Large but variable quantities of sand are handled mechanically in the ingot-moulding department, where an output of thousands of tons a week must be reconciled with wide variations in the size and shape of the product—for the ingots cast in the moulds may range in weight from 1 cwt to 60 tons or more.

Strict control over the ingredients and their proportions is exercised by the laboratories and research department. Optimum moulding qualities are ensured by careful sampling and treatment and the admixture of additives such as bentonite, which helps to create the plasticity needed for the formation of long, slender cores (and, incidentally, the stickiness that is one half of the handling problem).

Discharge from the overhead belt conveyor to the appropriate bunkers is effected automatically by ploughs actuated by level-controllers, each bunker being fitted with a low-level and a high-level probe. Incoming sand is



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6

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*Fig. 5. View of underside of curved-pan conveyor, showing centrally mounted roller chain and side-mounted rollers running between two pairs of rails*

*Fig. 6. These rollers are fitted with labyrinth seals. After more than 10,000 hours of running they showed no sign of wear, despite the highly abrasive nature of the foundry sand*

*Fig. 7. Knockers mounted at head of conveyor to assist discharge of the exceptionally sticky material*

ploughed off first, to bring the service stock in each unit up to the level indicated by the lower probe, after which the bunkers are filled to the upper level. When this has been reached, a relay signal is passed to the main distribution controls, cutting off the discharge from the mixing plant and diverting the sand already in circulation back to a storage or service hopper.

Reclaimed sand from the knockout is scraped by Drott skid-shovels into manholes in the floor discharging on to a reclaim conveyor system. The material is passed under magnets for the removal of metallic inclusions, screened to free it from coarse aggregate and dust, and returned to the mixing plant.

This system has been in operation for many years. Until August, 1957, the orthodox procedure, employing a bucket elevator, was followed for raising the material from the underfloor to the overhead conveyor. The usual difficulty was experienced in discharging the buckets and the usual high mainteance costs were incurred in dealing with the sticky abrasive material.

These conditions were not, however, accepted with complacency by Distington's management in their continuous search for ways of improving the efficiency of any processes that are below the general level and thereby raising the overall standard.

When Wharton Engineers (Elstree), Ltd., introduced the W.S. all-steel curved-pan conveyor they perceived its potential capacity for solving one of their long-standing problems. In August, 1957, the traditional bucket elevator was replaced by the W.S.13 conveyor seen in Figs. 1-8.

**Efficiency Doubled**

Basically, the W.S. conveyor consists of overlapping curved steel pans centrally mounted on a continuous roller chain and thus presenting a conveying surface that is resistant to heat and abrasion and can be flexed in any direction, vertically or horizontally, while still maintaining the overlap at the centre. The chain is carried round head and tail sprockets of simple construction (Figs. 10, 11 and 12), both of which are divided into three segments, and the assembly is carried on rollers attached to the pans which run on rails and maintain the conveying surface in a horizontal position. The arrangement is illustrated by the diagrammatic section, Fig. 9, which shows the rails supporting the upper load-carrying portion of the conveyor and the lower return runners. The loaded section of the driving chain, it should be noted, is below the level of the rollers; thus the tension maintained in the chain holds the pans closely together.

The diagram represents a horizontal section of the conveyor. On elevating sections guide-rails are fitted, as shown in Figs. 5 and 6, and flights are attached to the carrying surface. The photograph reproduced in Fig. 8 was taken at the Wharton Engineers works at Elstree, where the equipment was assembled and erected before being dispatched to the Distington foundry.

*Fig. 8. W.S.13 conveyor erected at the works of Wharton Engineers (Elstree), Ltd., before dispatch to the Distington foundry*

When first installed, the conveyor ran at a speed of 82 ft/min and was capable of handling 60 tons of sand an hour when fully laden. It has now been speeded up to 130 ft/min to provide a maximum capacity of 75 tons/hr. At the intake end the conveyor is horizontal and can thus be fed directly from the underfloor belt. It then rises at a gradient steeper than 65 deg. to enable the load to be discharged on to the overhead system without causing any appreciable obstruction of floor-space.

Evacuation, which is assisted by a knocker, is virtually complete, and there is very little spillage—a remarkable achievement when dealing with this unusually sticky material and a great improvement upon the previous method which succeeded in discharging only about 50 per cent of the material elevated.

Having run continuously for 24 hours a day on five days

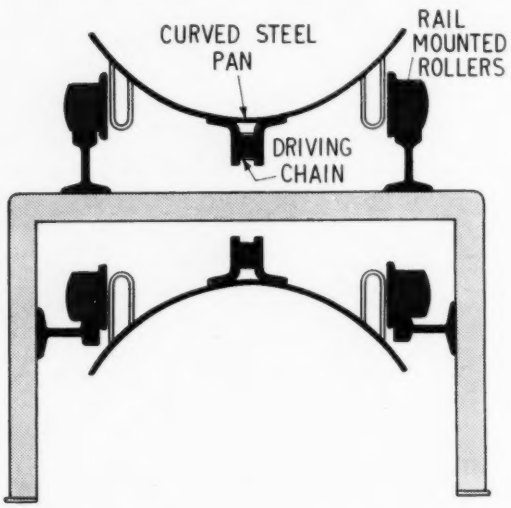



*Fig. 9. Diagrammatic cross-section o a typical W.S. conveyor, showing relative positions of driving chain and rollers. Rails as shown here would be for horizontal sections only; elevating sections are fitted with guide-rails*

of the week, the conveyor has now completed some 10,000-12,000 hours of service. After 7½ months of operation the pin-jointed driving chain was replaced by a roller chain. The travelling rollers and other moving parts are still in good condition, despite the fiercely abrasive action of the sand.

### A Wise Choice

Events have proved the wisdom of the management's decision to adopt this unorthodox method of dealing with an old foundry problem—a problem that has its roots in the adhesive and destructive qualities of the moulding sand. This finely graded, gritty, plastic material gets into everything that is not imperviously sealed against it, causing an appallingly high rate of wear in moving parts, and tends to stick to the smoothest of surfaces.

In having the ability to rise from the horizontal to an inclination of 69 deg or steeper (the maximum for the W.S.13 is 80 deg), the curved pan conveyor avoids the digging action of a bucket elevator which consolidates the material and makes it cling more tenaciously to the surface with which it comes in contact.

Wear is reduced by the simplicity of the design and the fitting of really effective labyrinth seals on the rollers. Any replacement that may be necessary, whether as a result of damage or for any other reason, can be effected in less than an hour—the only exception being the replacement of a complete chain and the remounting of the pan. Thus the exchange of the segmented sprocket, which was undertaken for the purpose of raising the final drive ratio, involved but a fraction of the downtime that would normally be needed for a change to be made in the operating speed of the better-known alternative types of equipment.

Serious damage, of the sort that might be incurred through jamming, is prevented by the fitting of an hydraulic coupling between the motor and the worm reduction gearbox. On four separate occasions the Distington conveyor was jammed by large foreign objects, but each time this happened the Vulcan Sinclair coupling took the strain until the inclusion was removed and normal running was resumed.

Alternative equipment to the Vulcan Sinclair unit would be a Crofts hydraulic coupling, and a David Brown 'Radicon' or Holroyd worm reduction gearbox could be fitted in place of the Crofts gearbox supplied with the Distington conveyor. Driving power for the Distington unit, which is 38 ft long between sprockets, is provided by a 5-h.p. motor, operating under the control of thermal overload switches incorporated in the starter assembly. For a W.S. conveyor of similar type running at a speed of 65 ft/min, a 3-h.p. motor would usually be recommended by the makers.

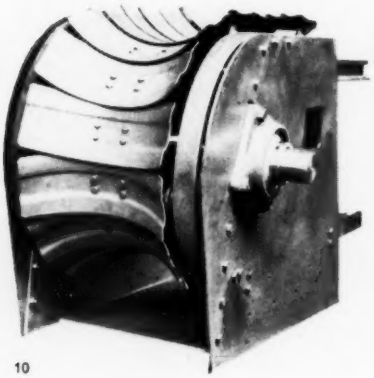
**Acknowledgment**

We are grateful to the management of Distington Engineering Co., Ltd., for affording us the facilities for visiting their works and publishing this account of their activities.

*Fig. 10. Head unit complete with pans. Overlap is maintained while pans are carried round sprockets and their curvature tends to concentrate material at centre during discharge. These features combine to reduce spillage*

*Fig. 11. Head unit without chain and pans. Bearings are mounted in plummer blocks for easy replacement. Segmented sprocket can be replaced without removing shaft or breaking chain*

*Fig. 12. This view of tail unit shows simple means provided for adjusting tension in chain*



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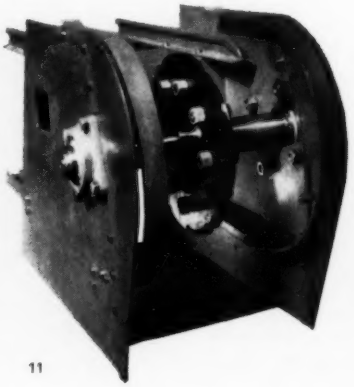

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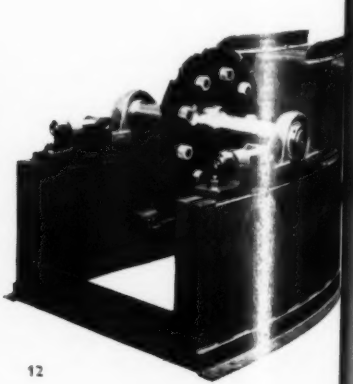


12

G. P. Copping, B.Sc., A.M.I.E.E.,* P. S. Gerard, B.Sc., A.M.I.E.E.,* and J. D. Andrews, A.M.I.E.E.*

# THE AUTOMATIC FACING OF LETTER MAIL—PART 1

*An article published in the November, 1958, issue of 'Mechanical Handling' described the various steps in the mechanical preparation of mail for automatic facing and cancelling. The present article deals with the problems involved in the completion of the processing.*

## Section 1. General Description

A VAST labour force with its correspondingly high wages bill is required to handle the mails in the U.K. Whereas there is little hope of introducing mechanization at the collection and delivery ends of the handling, beyond easing the postman's load by providing transport, there is considerable scope for mechanizing some of the operations which take place in the sorting office.

A previous article which described the mechanization of certain sorting office processes listed the various treatments to which pillar-box collection matter has to be subjected before any destination sorting can commence. These treatments, although vital, are unknown or unappreciated by most of the general public and yet they absorb a considerable amount of man power, in addition to that required to perform the actual sorting operation. The mechanization of this latter operation has already been reported in *Mechanical Handling*.†

The most tedious and repetitive process which sorting office staff have to perform before sorting of box collection mail can commence is termed facing. When performed manually, it involves the employment of a great number of men who are required to pick up items one at a time from the heaps of mail which are emptied from the collection bags on to long tables as the bags are brought into the office. As each item is picked up it is treated according to its nature. If a packet, it is placed on a conveyor which runs along the centre of the table as can be seen in Figs. 1 and 2. If a large letter, it is placed on a shelf above the conveyor. Whilst, if it is a small or long letter, it is collected into a pack which is held in the operator's hands. Such packs are held until they build up and become unwieldy whereupon they are placed carefully on a second conveyor. This runs in the opposite direction to the packet conveyor and is actually the return half of that conveyor; it terminates near the automatic stamp-cancelling machine associated with the tables. Separate packs are formed of the various types of item; i.e. first class short items (letters bearing a 2d. and postcards bearing a 2½d. stamp), second class short letters (items bearing a 2d. stamp) and first and second class long letters.

As each item is added to a pack it is twisted to arrange that all stamps appear in the same corner of the pack. It is this action which is termed facing although the word is generally understood to include the other sifting operations described.

*Fig. 1. Manual facing table fully staffed and loaded*

*Fig. 2. Collection of faced packs at end of manual facing table*

The packs of faced letters travel the length of the table conveyor until they reach the end, where they are picked off by a postman and stacked in their separate classes preparatory to being manually fed to the automatic stamp-cancelling and dating machine. (See Fig. 2.)

It is necessary to explain that the first and second class matter is separated in order to spread the traffic load in the office. By separating the two classes it is possible to concentrate on dealing with the first class matter and ensuring that this catches vital scheduled transport connections, before the staff is deployed on handling the second

* Post Office Engineering Department, Dollis Hill Research Station
† *Mechanical Handling*, April & May 1957.

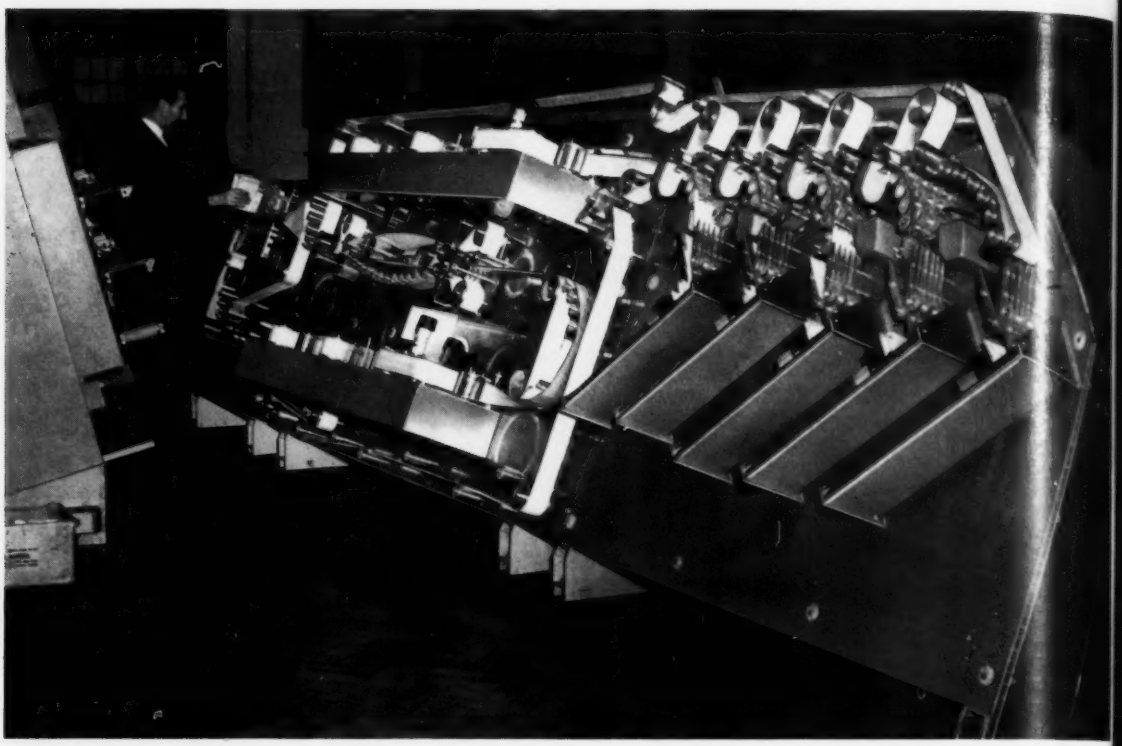
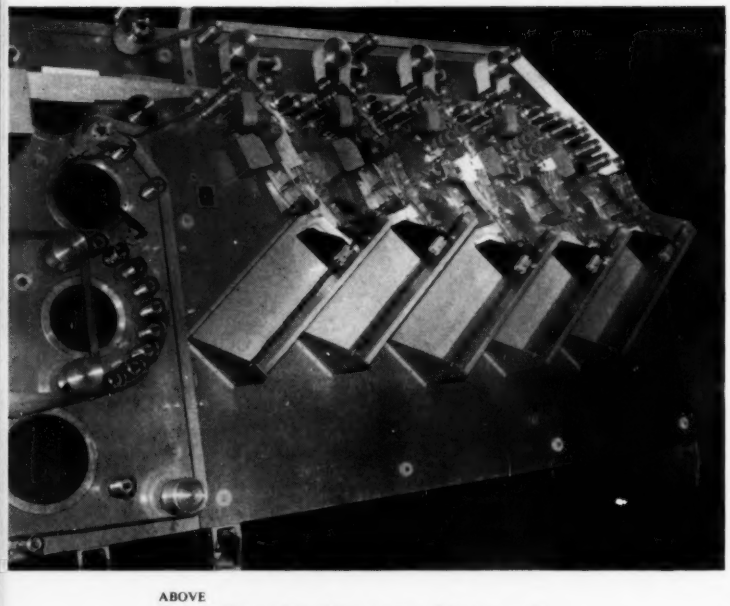


*Fig. 3. General view of facing machine, illustrating loading of feed mechanism in the background*



ABOVE
*Fig. 4. View of stacking section of facing machine*

class matter which is paid at a cheaper rate and not guaranteed such high grade service. Distinction is not drawn between first and second class matter during the morning and early afternoon but is introduced in different offices at different times according to the weight of traffic and the various dispatch schedules.

From the above it will be appreciated that the mail is subjected to a variety of treatments on a manual facing table besides that of facing itself and that provision must be made for all such treatments when attempting to mechanize the work.

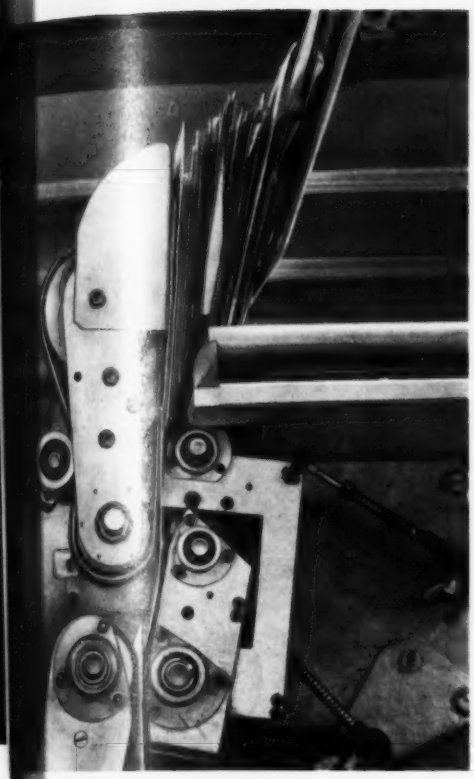
Machinery has been developed† which provides for the segregation of packets and large letters and the formation of the remaining matter into separate stacks of unfaced short and long items; this machinery, however, does not provide for the facing of the items, the cancellation of the stamps or the division into first and second class matter. This article describes the machine which has been evolved to complete the processing; it is illustrated in Figs. 3, 4 and 6.

Facing is performed both to permit machine cancellation of the stamp and to prepare the mail for easy handling by a sorter. The British public almost invariably conform to the regulation which warns of possible delay if the stamp is not affixed in the top right-hand corner relative to the address; this universal practice permits a simple technique of handling to be employed to achieve facing by machine. Since the stamps are affixed in the top right-hand corner reference to Fig. 5 will show that as long as an item is

*Fig. 5. Possible positions of a letter resting on its long edge*

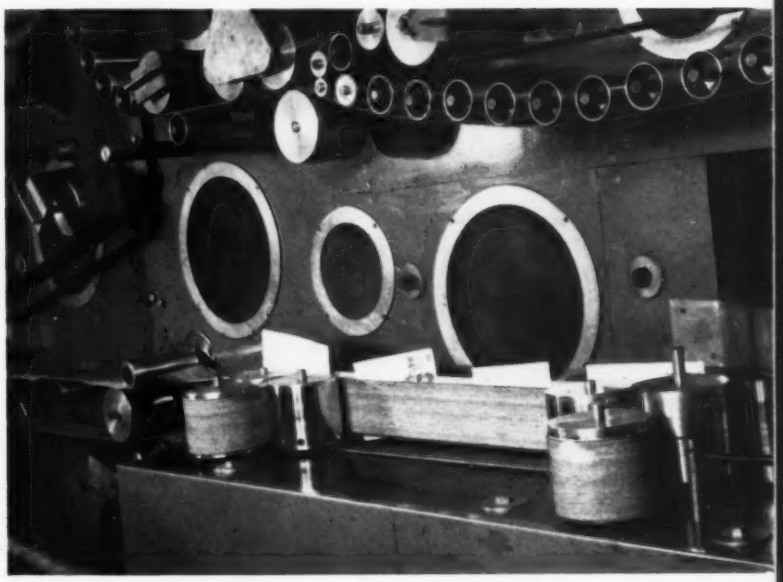
resting on one of its longer edges there are only four possible positions in which the stamp can lie. This in turn

† *Mechanical Handling*, Nov. 1958, pages 725-729.



LEFT
*Fig. 7. Destacking or stream forming mechanism*

BELOW
*Fig. 6. View of the first 'settle down' section*



implies that the areas which must be scanned in order to determine the position of a stamp on a letter can be limited if items are examined whilst resting on a longer edge.

The segregation and separation machinery to which reference has already been made and through which the mail must pass prior to entry into the actual facing machinery has been designed to collect those items bound for the facing machine (i.e. small and long letters) in separate packs wherein, although all long edges are aligned, the items are otherwise oriented in a random fashion. The alignment of the long edges of these items permits them to be automatically detached from such stacks one item at a time, and be ejected in a stream wherein all items move in single file in a direction parallel to their long edges. This stream is carried into the facing machine and passed across two sections termed shelves on which, during their passage, every item is scanned photoelectrically and by other means in the four corners where a stamp might be expected to lie. After scanning, the items are repositioned according to the findings of the scanners, as is described later, so that stamps appear in specific corners when the items reach terminating stacking trays. The mechanism employed to form the stream is illustrated in Fig. 7; it is a simple pneumatic device incorporating an endless perforated belt which slides across the face of a suction mouth into which air is sucked continuously. The letters to be fed into the conveying system of the machine are placed, all resting on one of their short edges, in a long stack on a floor of rotating rods. Items in this stack are constrained to lie in a nearly vertical plane by contact with the perforated belt at one end and a sprung plate at the other; the sprung plate allows the stack to be replenished without stopping the machine. The rotation of the rods greatly reduces the resistance to lateral motion of the stack and this allows the stack to move readily sideways under the action of the sprung plate, as items feed out at the belt end, without unduly compressing the stack and causing adjacent items to adhere to each other.

As each item comes in contact with the perforated belt it is subjected to a force tending to move it vertically downwards on one side and to a much smaller restraining force, due to its contact with the following letter, on its rear face. Both letters, and possibly later letters, tend to move downwards. Rubber fingers, however, prevent all but the leading letter, which is gripped hard against the perforated belt by the suction, from moving downwards more than a fraction of an inch. This state persists until the trailing edge of the leading letter clears the suction mouth, whereupon the second item becomes in turn strongly influenced by the belt. The action is continuous and a stream of items lying nose to tail emerges. The stream is then fed between accelerating rollers which generate spaces between adjacent letters, the size of the spaces depending upon the length of the items and the speed increase.

At present the facing machine is designed to handle only letters up to $7\frac{1}{4}$ in in length. It is to be modified to enable it to be prepared at will for processing also letters up to 10 in or more in length. A speed change control on the accelerating rollers is therefore to be introduced to enable the required space of nominally 3 in between letters in the stream to be maintained whichever length range it is desired to handle.

When spaced, items flowing in the stream are ready for individual examination by a suitable scanning device (see Section 2) which need only concentrate on the four possible areas of each envelope wherein a stamp may lie to ensure detection of the stamp. There are a number of different systems of conveyance and examination that can be adopted which automatically reorientate the items as required to

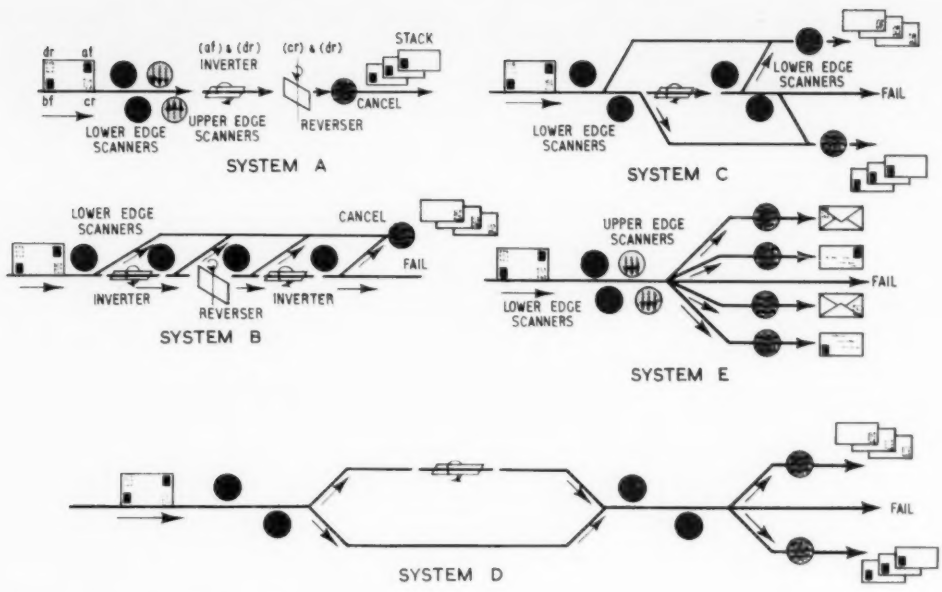



*Fig. 8. Methods of facing letters by machine*

permit their restacking with all stamps in a common corner. Some of these systems, all intended to achieve the same objective, are illustrated in Fig. 8.

System A illustrates a method wherein all four possible stamp positions are viewed simultaneously or at least before the next letter arrives at the scanner. Signals from the scanners pass to an electronic analyser from which the analysed information passes in turn to some form of memory system controlling the operation of one or other of two reorientating mechanisms. These mechanisms operate appropriately when each of the passing letters reaches them. In this way it can be arranged that in whichever one of the four positions the stamp appears as the item enters the system, all items emerge with the stamp in a common corner. Theoretically this system is sound but, as the reorientation mechanisms are required to operate at very high speed in order to achieve an acceptable overall rate of handling and to operate with items which vary greatly in length and character, the system is not considered practical. A further disadvantage is that a battery of scanners is required to cover the upper areas in which the stamp may appear due to the variation in the height of items.

System B is also theoretically sound but, although the rotating of items whilst in motion about an axis parallel to their direction can be effected readily, such is not true of the rotating of an item about an axis normal to the direction of motion as is required of the centre mechanism in this instance. This solution is therefore also not practical.

System C, however, avoids the need for the above difficult movement and is therefore quite practical but it unfortunately results in the formation of two separate faced stacks wherein the stamps appear near the lower leading corner in one and the lower trailing corner in the other. This fact is, however, of very little importance because the two stacks can be aggregated readily by twisting one appropriately before bringing them together.

System D is more acceptable than system C because the conveying mechanisms are more readily provided and less complex. In this system, on average, half the stamps pass undetected by the first two scanners due to these being arranged to look only for stamps located near the lower long edge. After passing the scanners, therefore, the items bearing these undetected stamps are directed to follow the path along which they will be subjected to a horizontal twist so that they will be inverted to bring the upper edge near to which the stamps evidently lie, to the bottom. At the point, therefore, where the alternative paths rejoin, all stamps must lie near to a common edge and a single pair of scanners, identical with the preceding pair, can then view all stamps and determine on which side of the item the stamps are affixed. This system is the one which has been adopted in the U.K. and Fig. 3 illustrates scheme D in practical form.

System E is a further alternative but, although theoretically acceptable, it introduces a battery of scanners to cope with the examination of the upper edge of items of varying height and also no less than four cancelling units and four stacking mechanisms. It does, however, avoid the need for any reorienting component mechanism and requires only a very short signal store control unit.

All the schemes described and any variations will inevitably require some form of signal store or memory system to control the routing and treatment of the individual items if such routing or treatment is not effected before a following letter reaches the scanners. Physical problems render the complete avoidance of a memory very difficult and some form of follower memory wherein the controlling signal is moved in step with the travel of the letter is usually employed. In this type of memory, when the item reaches the actual reorientation mechanism the control signal will have stepped along its own path and simultaneously reached a read-off point to activate the mechanism.

It is of course essential that all items maintain a strictly constant velocity during their passage with such a system of control and in order to provide this requirement it is imperative that all items be positively gripped throughout their journey. Such a grip can be provided by transporting the items between driven and spring-loaded rollers, between rollers and a belt against which the rollers press or between two belts.

The cheapest of these alternatives is the twin belt system whilst for carrying items round curves the roller-belt system has advantages. The roller-roller system is most useful for short runs where the difficulty of arranging for a short belt to run true becomes a problem. Unfortunately the

twin-belt conveyor has one great disadvantage; it is very prone to donate electro-static charges to the passing items which then become uncontrollable when it is required to stack or otherwise manipulate them. This disadvantage stems largely from the fact that firstly it is very difficult to match the speeds of two belts perfectly, and so avoid rubbing, and secondly that at any point where the belt is subjected to bending, static will very likely appear.

On the present machine a very simple and satisfactory solution to the speed-matching problem has been evolved by careful design of the conveyor system and the longitudinal twisting of the belt at suitable points. It is difficult to discern from Fig. 3 that although sections of the belt run side by side in contact in many places, and in the centre of the illustration no less than three sections appear to run parallel, the belt is in fact one endless loop 145 ft long. By careful threading it provides twin-belt conveyance throughout the greater part of the machine and in addition provides delightfully simple means of inverting those items that require such treatment. To illustrate how an endless belt can provide such a facility Fig. 9 is included. In the case of this illustration a 360-deg twist must be inserted in the belt before joining the ends of the loop, but if two such inversion sections, one left-hand and the other right, are included in a system the endless loop belt need have no longitudinal twist inserted before forming the loop. In the case of the present machine the second inversion section is distributed and lost by suitable routing of the belt through the two shelf units along which the primary and secondary scanning operations are performed.

If a twin-belt conveyor is formed in this fashion, static troubles do not arise due to rubbing because, as two sections of the belt forming a twin conveyor are part of the same belt, they must naturally be travelling at exactly the same speed (unless the belt is stretching over some sections and contracting over others, which is unlikely). There is therefore no rubbing action to generate static charges.

At points where the letter route curves, the appropriate strand of the twin belt is deflected and the remaining strand transports the items between itself and the rollers over which it runs; the deflected strand rejoins after the curve. The belt can develop static where it bends at the rollers but if the bend is not too sharp no trouble appears.

Diversion of the item is achieved by devices as illustrated in Fig. 10. These change the route of an item by the deflection of a narrow box-like member through which the item passes. At the apex of the junction point two interleaving rows of small rollers are fitted. These are staggered alternately along a common cranked shaft and, in conjunction with two sets of sprung rollers just discernible in Fig. 10, ensure that no item passes through the diverter mechanism without being strongly gripped at some point or points along its length throughout its passage.

*Fig. 9. Endless belt forming twin-belt inverting conveyor*

Power to swing the diverter boxes is provided by the main conveyor-drive motor via a half-revolution clutch. This is linked to the diverter by an eccentric and controlled by an electromagnet coupled to the electronic equipment described in Section 3.

Position-indicating photobeams are fitted at various points along the letter paths. These and the reasons for their presence are described in detail later but one appears immediately before each diversion point to ensure synchronism between arrival of items and operation of the diverter.

Two systems of scanning are embodied in the machine. These are described in detail in Section 2. Of the two systems, one is purely photoelectric and reacts to the reduction in the light energy reflected when a small sharply focused scanning beam impinges on a stamp instead of on a more lightly coloured envelope; the other reacts to the presence of conductive lines specially printed on the back of the stamps under the gum. A third system, which would involve treating the stamp paper with a non-radioactive phosphorescent compound, is under current investigation.

Scanning by means of the photoelectric system alone is not sufficient because of the too frequent appearance of misleading marks on items. Furthermore, a more complex trichromatic form of the system which would be necessary to provide the essential discrimination between brown 2d. stamps on second class mail and the remaining lower denominations is considered unreliable for field use. This discrimination can be readily achieved in a laboratory by photoelectric means but the efficiency of the system drops when live letters have to be scanned. Some other means (e.g. by donating different individual characteristics to the various groups of stamps between which distinction is required) is necessary for each discrimination, but photoelectric scanning may always be required in order to cope with the considerable proportion of items such as official paid and business reply, etc., which travel without an adhesive stamp.

Immediately before the points at which the travelling items are scanned for a stamp, precautions have to be taken to ensure that the lower edges of all items move along a fixed line and that the areas which will be examined by the scanners are those in which stamps may lie. This requirement is met by twisting the belt conveyor to bring items into the vertical plane and then drawing the twin belts apart for a short distance prior to reaching a scanning point. This permits the items to settle down squarely on to a horizontal belt running the length of the spaced section. The action and the spaced section which precedes the first scanning point are illustrated in Fig. 6.

In order to provide for the segregation of first and second class mail, it has of course been necessary to double the number of faced letter outlet points from the machine and as the illustration shows there are five such points. Two are for items bearing a stamp near the leading edge of the letter, one for first class mail and the other for second, and two similar boxes are provided for items bearing a stamp near the trailing edge. The fifth box is for stacking those items which bear no stamp or otherwise defeat the machine.

Cancelling and date-stamping mechanisms are installed in the four letter paths between the diversion points from the main stream and the four stamped-item stacking trays. The printing dies are each rotated as required via a single revolution clutch which is released electromagnetically under the control of a photobeam system. This beam is positioned

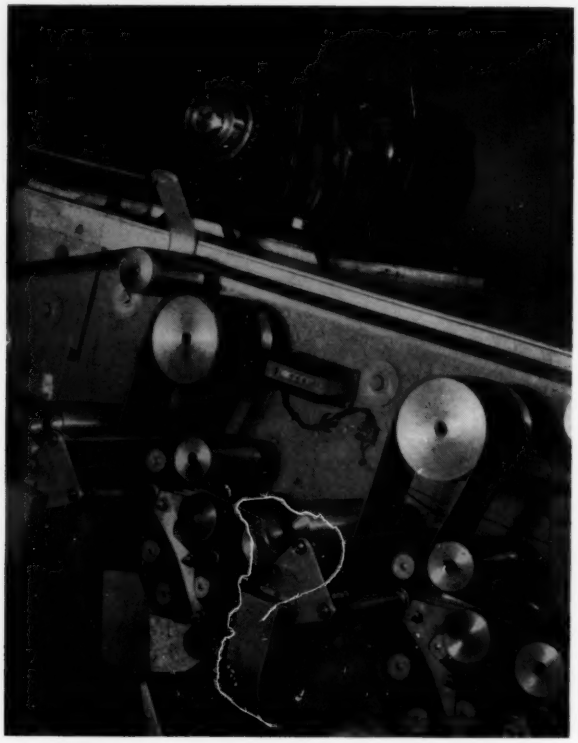


*Fig. 10. View of two diverting units. Both units are in the straight-through position and the pivoted directing boxes are visible*

*Fig. 11. Processed letter stacking mechanism*

to cause the dies to contact the desired area of the envelope as they rotate.

The items are stacked in sloping trays in order to apply a slight gravity pull on the stack. The floors of the trays are covered with a layer of P.T.F.E. and the stack supported at its lower end by a sprung plate which counters the gravitational pull. The spring controlling this plate is designed to balance the weight of the stack as this varies in length in order to maintain as far as possible an actual gap or very light pressure between items at the head of the stack; the arrangement permits the clearing of the stacks without stopping the machine. Fig. 11 illustrates a partially filled tray and also the tiled arrangement of the items as they enter.

Unless special precautions are taken, the possibility of items which are entering a stacking tray butting on to items which have already entered is great. In order to remove this possibility the rollers which feed into the stack have been arranged to make only one half revolution as each letter contacts them. The rollers are driven from a single revolution clutch via a special epicyclic train of gears which imparts a smooth acceleration and deceleration characteristic to their motion. Operation of the clutch is controlled by a photobeam directed across the letter stream a few inches in front of the feed-in rollers. The gearing of the rollers and the position of the beam are arranged to provide that the peripheral speed of the rollers is at its maximum and matches the approach velocity of the item as this makes contact. The diameter of the stopping and starting rollers is approximately 2 in and this, in conjunction with the velocity matching mentioned above, provides that as each letter contacts them it does not clear them but comes to rest with only 1½ in of its length protruding. If, therefore, a file of spaced items approaches the tray, they are retarded in turn and collect in the form of an overlapping stream (lap distance 3 in) in which condition they cannot butt on to each other as they move step by step fully into the forming stack. Fig. 11 also illustrates that the line of approach to the stacking tray is bent immediately prior to the half revolution rollers. This feature is introduced in order to cause the tails of entering items to swing well clear of the line of approach of following items.

The belt speed of the machine in its present state of development is 330 ft/min which provides for a handling rate of approx. 360 short items a minute when operating with a spacing of approximately 4 in between letters.

Automatic shut-down of the machine in the event of a letter becoming jammed and automatic detection and routing of overlapping or too closely spaced items to the failure tray are provided. Details of these facilities appear in Sections 2 and 3, to be published shortly.

*All photographs accompanying this article are reproduced by courtesy of H.M. Postmaster General*

*(To be continued)*

**SEVENTH**
**MECHANICAL HANDLING EXHIBITION - 1960**

The Seventh Mechanical Handling Exhibition (organized by this journal) will be held next year at Earls Court, London, from Tuesday, May 3rd, until Friday, May 13th, 1960.

# ELECTROMECHANICAL LINEAR ACTUATOR FOR REMOTE CONTROL

By a Staff Reporter

*Many applications in the field of remote control are envisaged for a new linear actuator now on test in the Teleflex works at Basildon*

SIMPLICITY, versatility and reliability, are the attractive features of an electromechanical linear actuator developed by Teleflex Products, Ltd., which is now undergoing long-term endurance tests in their works at Basildon, Essex.

It represents a new line of activity for this company, which was prompted by the tendency of industrial plants and processes to grow in size and complexity and the accompanying necessity of controlling greater and greater loads from points more and more remote. The actuator is, however, in logical sequence with their mechanical system of cable control, which was at one time in universal use for the remote operation of boiler valves but began to lose ground as boilers became larger and the demand grew for push-button operation.

While satisfying this demand, the actuator has potentialities that extend far outside the field of boiler control.

## Design Features

Basically, the actuator is an electrically powered screwjack, capable of performing the functions of a pneumatic cylinder or hydraulic ram. The free end of the jack carries a fork-end capable of rotation through an angle of 90 deg, and the other is anchored to a fixed point.

The plunger is extended and retracted by the rotation of a screw in a double-circuit recirculating ball-nut. Power is supplied by an electric motor with high-temperature insulation, which is built into the body of the actuator and is totally enclosed. Full-load current is less than 1 Ah. Sealed bearings are fitted to the motor shaft and the ram tube has a neoprene wiper-seal. All internal wiring is insulated with fibreglass and silicone rubber.

The actuator is substantially weather and corrosion proof and maintenance engineers will welcome the provision of a rustproofed steel sliding hood and the absence of gaiters.

Power output can be set to a predetermined value, within the limits stated in the performance table. When the required load is attained the actuator is stopped immediately by mechanical means. Reliance is not placed on slipping clutches or thermal overload switches and no excess load is sustained in any part of the mechanism. A solenoid-released twin-disc brake checks over-run and ensures instant and positive locking at any position of the stroke.

Control can be effected by load-cutout or travel-limit switching. By the first method the actuator can be used to build up and maintain a predetermined pressure for an indefinite period without the necessity for maintaining an electrical circuit.

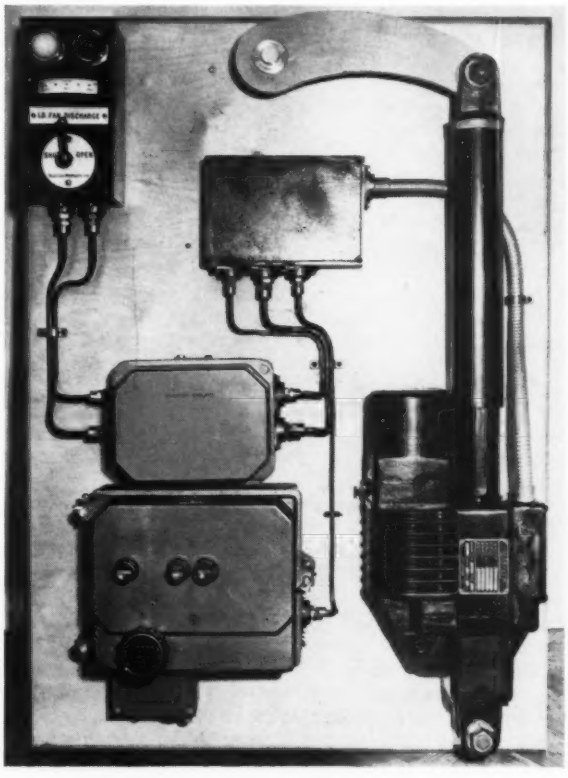
Travel in either direction can be controlled by built-in cam-operated limit-switches enclosed by a sealed cover. The switches can be adjusted on site and remote indication of length of travel is provided by a pointer in the cover. A control position indicator, consisting of a variable-resistance transmitter coupled to a moving-coil receiver in the control panel, is available with step-down transformer at a normal operating voltage of 12 V. Pilot lamps, operating at a reduced voltage, can be used to indicate extremes of travel or load.

Provision is made for manual operation of the plunger, when setting up or in the event of a power-failure, by means of a plug-in handle. It is accessible from either side and electrically gated for safety.

Two models are now in production. Details of their performance are given in the accompanying table. Length of stroke is 12 in for standard equipment, but other lengths are available, the use of bar and tube stock in preference to castings for the manufacture of the plunger and cylinder affording infinite latitude in this direction.

An actuator linked with typical control gear is illustrated in Fig. 1. It is doubtful whether any other equipment affords

*Fig. 1. Display panel featuring Teleflex linear actuator linked to typical heavy-duty equipment. Actuator, on right, with plunger partially extended, is operated by press buttons on contactor box. Position indicator and lamps indicating extremes of travel and load are mounted on instrument panel. Under site conditions the actuator and upper junction-box would be remote from remainder of equipment*



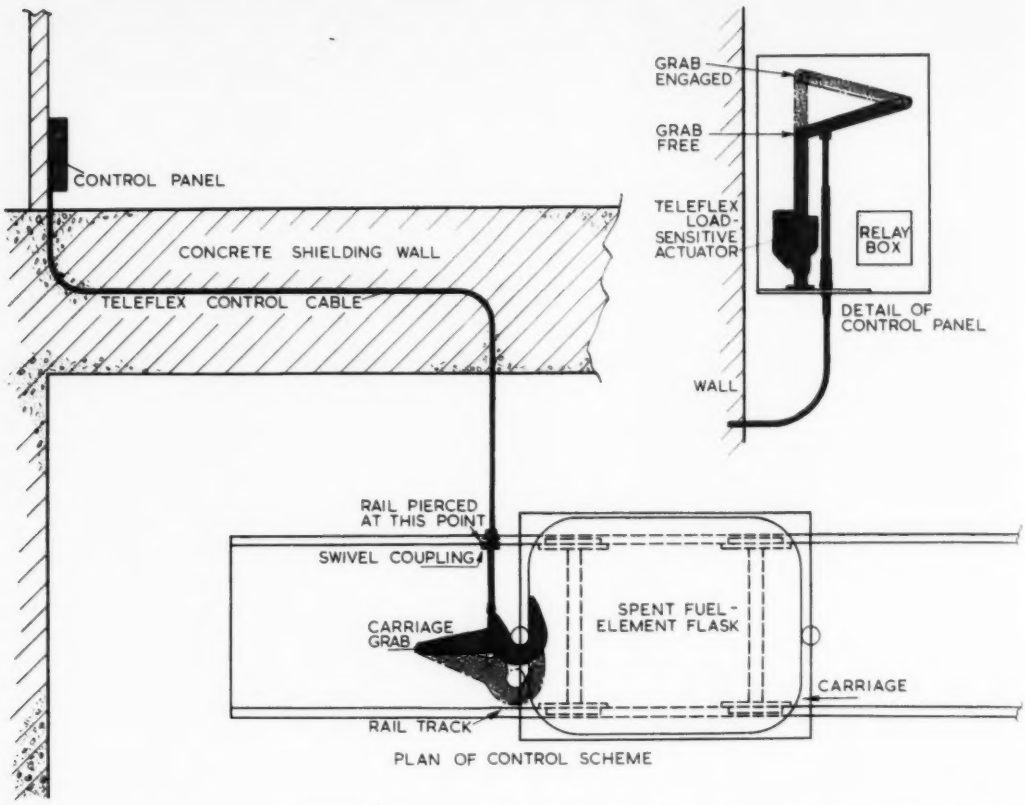



*Fig. 2. Schematic diagram of remotely controlled positioning system for spent-fuel carriage. Movements of grab are initiated by Teleflex linear actuator mounted in screened control room and transmitted by heavy-duty cable in stainless-steel conduit following serpentine path through 10-ft concrete wall*

the combination of desirable features incorporated in the Teleflex unit.

**Applications**

If used as a positioner or manipulator, with the extent to which the plunger travels under immediate and accurate remote control, the actuator has immense possibilities. In those connected with the handling of materials, it might be used to operate a gate or plough at a distant point on a conveyor line, or to handle material in dangerous or inaccessible places, or material that was itself dangerous or harmful. Its ability to function under conditions of extreme heat or cold would enable it to be used where hydraulic systems would be out of the question, as, for example, in a steel-works for feeding items to the heat-treatment furnaces, or in a cold-storage area for the operation of conveying or lifting equipment. It would also be acceptable under many conditions where pneumatics were not.

Travel-limit switches could be made to respond to signals initiated at the control station, perhaps in conjunction with an image projected on a television screen, or by automatic sequence relays. Or they could be triggered at any point along the operating route.

If the actuator was operating as a load-sensitive instrument under the control of load-cutout switches, it could be employed for building up and maintaining pressure against a valve or compression spring, or against a load of material. Many applications would then present themselves in the field of plant or instrument control, or in circumstances more directly associated with the handling of material. The equipment could be used, for example, to build up a bank of work in progress, or a buffer stock, which would be released when a predetermined load-level was reached.

Interesting possibilities are suggested in connection with safety in mines or other situations where long lengths of conveyors must be left to operate unattended, or stresses leading to overloading could build up unobserved, for one can envisage the possibility of using the actuator to maintain a constant tension in a belt or a constant thrust and to trigger off a warning signal when a stress was suddenly removed or reversed.

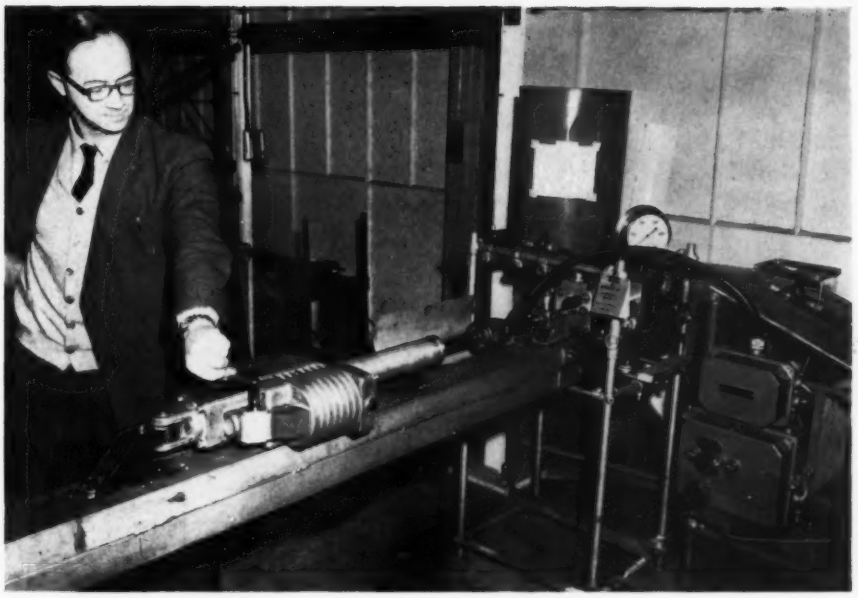
An application of an unusual type, but one that may be expected to recur with increasing frequency, was undertaken at the development stage. It is concerned with the handling of radioactive material at one of the new atomic power stations. One of the delicate operations in projects of this sort is the removal of spent fuel from the reactor, for the level of radioactivity in the fuel is still very high and the area around it is screened by a concrete wall 10 ft thick.

The fuel is contained in a flask, which is withdrawn by a hoist and raised to the rail-mounted carriage on which it is transported to a hot cell. The positioning of the flask in relation to the carriage is critical and is effected by means of a remotely controlled grab powered by a Teleflex actuator.

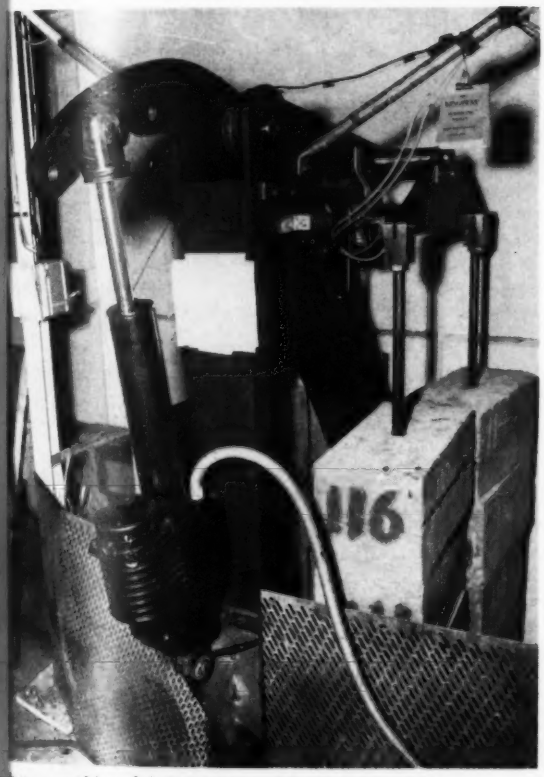
The arrangement is indicated diagrammatically in Fig. 2, which shows the actuator mounted behind the concrete shield-wall and linked to the grab by Teleflex heavy-duty transmission cable of 20,000-lb breaking strength. This cable is embedded in the concrete and made to follow a serpentine path to avoid presenting a straight route for the escape of radiations.

Hydraulics and pneumatics were ruled out as media of transmission, because radiation would be transmitted by oil or air. Hydraulic control gear could have been used with safety on the clean side of the wall, but would not have

RIGHT
*Fig. 3. Designer of electromechanical linear actuator demonstrates ease of exerting 3,500-lb pressure by means of hand lever. In this endurance test plunger is extended to full length of power stroke and is controlled by limit switch on return stroke*



BELOW
*Fig. 4. Actuation on this test rig has been operating continuously since Christmas. When photograph was taken it had lifted and lowered 3,000-lb loads of concrete blocks 324,000 times. By end of 1959 it will have completed 40 million cycles*



been capable of integration with the electronic sequence control system used for other operations. The scheme submitted by Teleflex provided the following essential features:

1. Precise location of the flask under the grab-head.
2. Sequence interlocking with the travel-limit switch in the actuator.
3. Agricultural simplicity of the mechanisms located in the actuator area (where the level of radiation is too high for maintenance operations to be undertaken).
4. Availability of manual control for emergency operation.
5. Visual indication of movements at the control panel.

**Tests in Progress**

Two long-term tests are now in progress. They are illustrated in Figs. 3 and 4. In the test shown in Fig. 4, which has been running since Christmas, the actuator is functioning as a regulator, raising and lowering concrete blocks weighing 3,000 lb, the load remaining in suspension all the time.

At the top and bottom of each short stroke, the movement of the plunger is arrested under the control of a cam-operated limit switch and the load is held on the return stroke by a brake. At the time of our visit the recording counter showed that 323,890 operating cycles had been completed. By the end of the year the figure will have reached 40,000,000.

In this test the actuator operates vertically, on a portion of its stroke. In the test shown in Fig. 3 it is operating horizontally and using the full length of its stroke. At the end of the power stroke it cuts out under a load of 3,500 lb and it cuts in again on reaching the limit switch at the end of the return stroke. When our picture was taken, the actuator was switched over to manual operation. Under that condition the quality of the workmanship was made apparent, for the movement of the screw was so smooth that no effort was needed to exert a pressure of 3,500 lb, despite the absurdly small lever-arm provided.

This endurance test is being continued indefinitely to provide design information for the manufacturers themselves and to prove the ability of the recirculating ball-nut assembly to stand up to prolonged continuous movement.

**Tabulated Performance Data**

| | Series 3000 | Series 1500 |
|---|---|---|
| Output | 3,000 lb at 12-in stroke | 1,500 lb at 12-in stroke |
| Load limitation | 0-4,000 lb | 0-2,000 lb |
| Speed | 32 in/min or 16 in/min | 32 in/min or 16 in/min |
| Power supply | 440 V 3-phase by 9-core cable to actuator body | 230 V 50 cycles A.C. |

# MECHANICAL HANDLING PLAYS BIG PART AT LUXURY HOTEL

INCREASED mechanical handling is enabling goods to be dispersed more quickly from the goods bay of Grosvenor House—the Park Lane, London hotel—to appropriate departments. For instance, a ton of potatoes now takes only 10 minutes to reach its store compared with any period up to an hour previously.

In the street-level goods bay two Slingsby hand-lift trucks are used to convey goods to the two lifts serving the basement dispersal area. Used in conjunction with these trucks are ridged metal tubs and stillages with specially strengthened metal tops which are especially suitable for handling meat, game and poultry.

Thousands of bottles are received each week and to enable them to be handled swiftly and with the minimum number of breakages, a special crate of wire and wood has been made for the hotel. The crates carry 1 doz. full bottles and are deep enough to hold and protect even a large hock bottle.

On arrival in the basement, goods are loaded on to an electrically operated Lansing-Bagnall pedestrian-controlled truck with a load capacity of 3,000 lbs. For silence and hard-wear it is fitted with nylon-covered wheels.

*Fig. 1. In the new goods bay: A Slingsby hand truck takes incoming crates of hock into one of the two lifts to the basement dispersal area*

One of the most important classes of goods handled by the hotel is linen. Baskets now arrive swiftly in the mezzanine level linen-room by travelling down a 65-ft long chute and roller conveyor, supplied by Herbert Morris, Ltd.

A special feature of the new goods bay, which is part of an extensive rebuilding programme for the hotel's service departments, is the 3-ft 3-in high platform, whose height was fixed after the height of the tailboards of about 500 vans had been measured. The goods bay can receive and unload under cover four vans simultaneously.

*Fig. 2. In the basement dispersal area a Lansing Bagnall electric truck takes a stillage load of empty bottles into the goods lift for return to the brewery. On the right one of the Slingsby hand-lift trucks brings in three full barrels of beer*

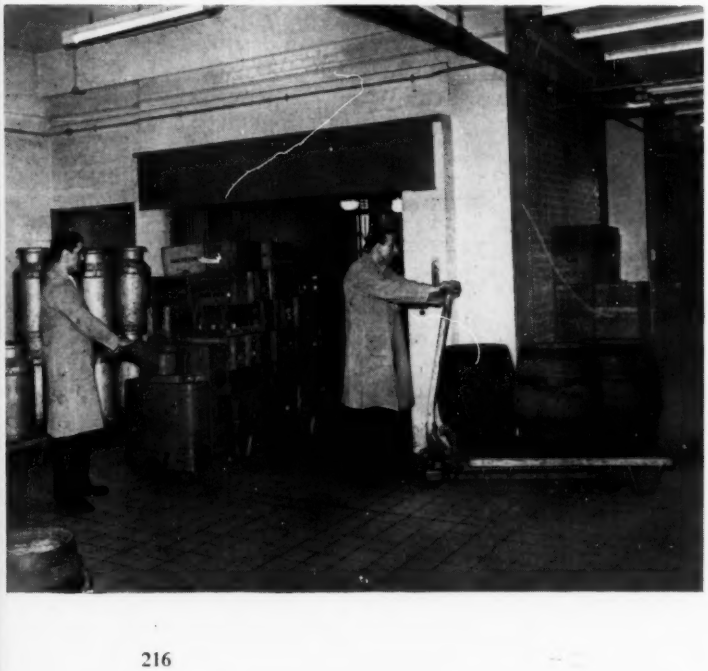


*Fig. 3. Incoming linen is sent from goods bay to linen-room by means of the steel chute and roller conveyor seen here*

A survey of mobile conveyors and elevators, portable and transportable conveyors, and similar equipment — Part 16

# 'NON-FIXED' CONVEYORS AND ELEVATORS

by J. M. Bevine, B.Sc.(Eng.)

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*Fig. 229. T. & T. flat band grip-face conveyor with manual-hydraulic height adjustment for vehicle loading and similar purposes and suitable for sacked materials, mail bags, etc.*

*Figs. 230, 231 and 232. T. & T. diesel engine driven mobile flat belt conveyor with variable inclination conveyorized feed table, showing typical positions of conveyor boom and feed table*

FOR THE HORIZONTAL TRANSPORTATION of unit loads and for their inclined elevation or lowering, wide use is made within industry of mobile flat belt conveyors, mobile flat belt elevators fitted with lifter-type flights, and chain and slat conveyors and elevators, as well as chain and rod elevators. Standardized and custom-built machines of these types are manufactured in large numbers by T. & T. Works, Ltd., representative examples being described in the survey which follows.*

**T. & T. Flat Belt Conveyors and Loaders**

A typical lightweight T. & T. vehicle-loading conveyor is shown in Fig. 229. This machine has a grip-face rubber belt and manual-hydraulic discharge height control. It is electrically driven and is available in a range of sizes and load capacities. Similar machines are also available with engine drives instead of electric motor drives, and with fixed discharge heights or manually controlled adjustable discharge height mechanisms.

Vehicle loaders of the type shown in Fig. 229 are ideal for the handling of bagged materials such as cement and flour, and for mail bags, etc. Similar machines made by T. & T. Works, Ltd., have slat conveyors instead of flat belt conveyors. Sometimes doubt exists as to which type of machine is the most suitable for a specific unit load handling task. In such a case it may be as well to remember that flat belt conveyors are particularly useful where there is any risk of damaging the sacks or packages handled, e.g. where paper sacks are in use. For more robust work, chain and slat conveyors are generally employed.

Modern flat belt conveyor design is well typified by the machine shown in Figs. 230, 231 and 232, which illustrates a T. & T. diesel engine driven, variable discharge height, flat belt mobile conveyor with a variable angle conveyor feed table, this machine has manual-hydraulic height adjustment and is available in a wide range of sizes and load capacities.

*T. & T. mobile troughed belt bulk materials handling conveyors and elevators were described in a previous survey, Part 8, *Mechanical Handling*, April 1958, pages 208-213.

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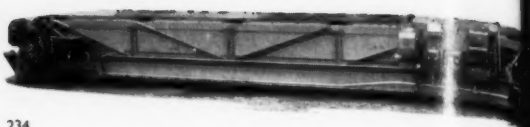

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*Fig. 233. Mobile rail-mounted T. & T. retracting conveyor at work in the loading bay of a hosiery factory*

*Fig. 234. T. & T. telescopic flat belt conveyor, with hydraulic height adjustment, in retracted position*

*Fig. 235. The machine shown in Fig. 234, with the boom extended and raised*

The feed conveyor may be angled to enable sacks, etc., to be loaded on to the machine directly from ground level, as in Fig. 231, or arranged as a horizontal feed table, as in Fig. 230, or at any other intermediate inclination. The rear of the machine is supported by four sets of swivelling castor wheels, the mid-section being supported on articulated wheel axle support arms and carried on pneumatic road wheels.

**Retractable Belt Conveyors**

For many vehicle loading purposes retractable belt conveyors are invaluable. Two examples of T. & T. retractable flat belt conveyor design are shown in Figs. 233, 234 and 235. Fig. 233 shows a rail-mounted retractable boom machine which was custom built for a large hosiery factory. This machine is mounted on rail wheels and may be moved under its own power, from one position to another along the track. The conveyor boom is of fixed length and incorporates a hinged section which enters the lorry or trailer to be loaded (or discharged) as shown in the photograph. The forward end of the hinged boom section runs on tracks within the lorry or trailer and is hydraulically raised or lowered to suit changing loading conditions within the vehicle.

The machine shown in Figs. 234 and 235 is a telescopic boom flat belt conveyor with hydraulic height adjustment. When retracting this belt conveyor doubles back on itself, as shown. This machine is electrically driven and it is fully mobile, being mounted on four sets of hard rubber swivelling castors.

**Special-purpose Slat and Flight-type Conveyors and Loaders**

Special-purpose slat or flight-type conveyors and elevators made by T. & T. Works, Ltd., include brick-loading flat belt conveyors for brick kiln to lorry loading duties (Figs. 237 and 238), builders' elevators and coal merchants' elevators. Brick-loading conveyors light in weight and easy to handle, they are especially designed for the emptying of brick kilns, and are available in any desired length, with petrol engine, diesel engine or electric motor drive.

T. & T. coal merchants' elevators are light enough to be regarded as portable, i.e. they are light enough to be carried; a typical example is shown in Fig. 239. Two versions are made: one, as illustrated, employs a flat conveyor belt

*Fig. 236. Belt and slat-type T. & T. mobile loader, as used in a ... renovation depot*

fitted with lifter-type flights; the other employs a troughed belt. Both types are particularly valuable for bagging coal and similar duties. Two men with one of these conveyors can fill two 1-cwt bags per min without undue exertion. Coal merchants' conveyors are suitable for general loading and stockpiling duties and may be obtained complete with stand or table, hopper and cut-off door.

T. & T. builders' elevators are light chain and slat type variable discharge height elevators, suitable for the handling of bricks and tiles, etc., from ground level to upper floors of building sites. Standard machines within this range are petrol engine driven and have a maximum discharge height of 20 ft 6 in, a typical example being shown in Fig. 245. The boom is raised and lowered by hand winch and the machine as a whole is mounted on front steel wheels of large diameter and weighs only 5½ cwt. It can handle 2,000 bricks/hr and is extremely useful where a direct feed is required from ground

level to bricklayers or tilers on an upper floor level or within a building, in which case the elevator may be arranged to enter the window opening at a shallow angle and go right inside the room in question. This elevator may be obtained mounted on pneumatic wheels. It may also be obtained in, larger and heavier versions to order.

Another special-purpose T. & T. mobile conveyor is shown in Fig. 247. This is a mobile drag scraper conveyor, shown at work unloading coal from a railway wagon and loading it on to a stockpile. This machine has a very practical loading hopper and is easily moved from wagon to wagon and from one point to another along the length of stockpiles. It is mounted on front pneumatic wheels and rear swivelling castors and is electrically driven. Larger mobile drag scraper conveyors of all kinds are available to order from T. & T. Works, Ltd., and for some purposes, e.g. where space is limited, it may be as well to remember that such machines may be more practicable than other types of mobile conveyor.

**Slat Conveyors and Elevators**

An extremely wide variety of standard and custom-built slat conveyors and elevators is manufactured by T. & T. Works, Ltd. These include light lorry loading fixed height elevators, variable discharge height loaders, and fixed and variable discharge height stackers, including hinged boom stackers and other types.

Various types of slat conveyor may be obtained, depending upon specific handling requirements. These include belt and slat machines, such as that shown in Fig. 236, close-slatted chain and slat machines, such as that shown in Fig. 240, and open-type chain and slat machines as well as chain and rod conveyors and elevators.

The belt and slat loader shown in Fig. 236 is typical of large numbers in use in all branches of industry. This particular machine is electrically driven and is used for loading renovated sacks on to lorries. Generally speaking, where textiles are to be handled and steep loading angles are required, belt and slat loaders offer important advantages because of their low damage hazard when handling easily damaged materials.

The belt and slat elevator shown in Fig. 239 has already been described elsewhere above. The point to note here, is

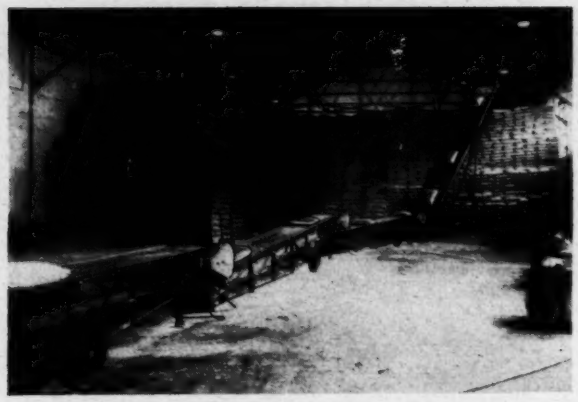
*Fig. 237. T. & T. brickworks mobile conveyor working between brick kiln and lorry*

*Fig. 238. Loading end of conveyor, shown in Fig. 237, within the brick kiln*

BELOW

*Fig. 239. T. & T. mobile coal merchants' conveyor at work*

*Fig. 240. Stockpiling bags of cocoa beans with a high output T. & T. close-slatted chain and slat elevator with hydraulic height adjustment*



the ability to make use of belts fitted with lifters for the fast and economic handling of bulk materials where steep inclinations are involved. In actual practice, T. & T. Works, Ltd., would suggest the most suitable type of belt for a particular application, a completely worked out design being proposed, rather than a standard machine which the user would be expected to accept as it stands or to modify to suit his needs.

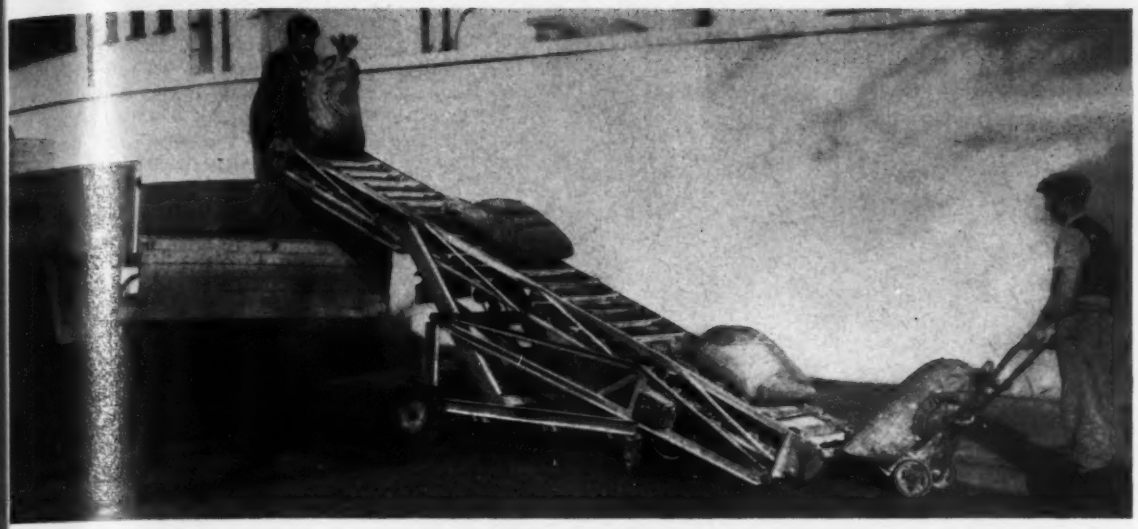
The machine shown in Fig. 240 is a T. & T. close-slatted mobile chain and slat variable discharge height conveyor. Its general design may be compared with that of the troughed belt conveyor shown in Fig. 103 (part 8 of this series). Structurally the two machines are alike and they are in fact different versions of one of the numerous T. & T. standard machines. The machine shown in Fig. 240 is being used for stockpiling cocoa beans.

For general warehouse use, where sacked or baled materials are being handled, open-type chain and slat conveyors and elevators are very widely employed. A typical example is shown in Fig. 241. Here three T. & T. horizontal belt conveyors in series are delivering sacks of sugar to a T. & T. variable discharge height elevator. Incidentally, the horizontal machines in question might equally well have been horizontal slat conveyors, as shown

TOP LEFT
*Fig. 241. Three T. & T. flat belt mobile conveyors in line, discharging on to a T. & T. chain and slat variable discharge height elevator in a sugar warehouse*

BELOW
*Fig. 242a. T. & T. sack elevators loading sacks of barley on to a coastal vessel*

LEFT
*Fig. 242b. T. & T. hinged boom chain and slat elevator reversing for off-loading directly from stockpile to lorry*



244a

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244b

*Fig. 243. T. & T. hinged boom chain and slat elevator loading railway trucks with sacks of china clay*

*Fig. 244a. T. & T. multi-way chain and slat loading conveyor at work. This is a variable discharge height machine which can also be arranged as a variable height horizontal conveyor and incorporate hydraulic height control*

*Fig. 244b. T. & T. variable discharge height single boom chain and slat elevator*

in Fig. 246. Fig. 242*b* shows another hinged boom chain and slat elevator reversing for off-loading sacks from stock-pile to lorry. Standard T. & T. machines of this type have hardwood slats which are attached to an extra-strong elevator chain, and slide along the steel plate bed of the machine. An alternative type of machine, also available, has two strands of precision roller chain, with a continuous belt of closely-spaced hardwood slats, without gaps at hinge points. In either case, standard machines have hand-winched height adjustments, but hydraulic height adjustments are also available. Electric motor or engine drives are available with all machines. The lower boom of every machine may be raised into a horizontal position, giving a feed table 4 ft 6 in above ground level. The upper boom may be raised to give a maximum discharge height of 12 ft to 24 ft, according to size. Larger machines are also available to order.

T. & T. chain and slat machines on outdoor duty are shown in Figs. 243 and 244*a*. The machine shown in Fig. 243 is a hinged boom chain and slat elevator and it is loading bags of china clay on to railway wagons. Fig. 244*a* shows an entirely different type of T. & T. mobile conveyor. This is a multi-way chain and slat elevator and is electrically driven and incorporates both hydraulic variable feed and height adjustments and variable height horizontal adjustment. The same machine can be used as an elevator and as a horizontal conveyor.

Another popular type of T. & T. chain and slat elevator is shown in Fig. 244*b*, this is a hand-winched variable-height machine which is ideal for vehicle loading and stacking duties. It has a single hinged boom and is available in various sizes, having maximum discharge heights ranging from 11 ft 11 in to 24 ft. The machine is normally electric motor driven but may be engine driven if required, it is mounted on pneumatic wheels and all rotating shafts run in self-oiling bushes.

**Other Types of Portable and Mobile Equipment**

Other types of portable and mobile mechanical handling equipment manufactured by T. & T. Works, Ltd., include roller-gravity conveyors (Fig. 251), unit-section belt conveyors (Fig. 250), short self-contained belt conveyors (Fig. 248) and semi-mobile conveyors, such as swinging-boom sack placers.

Fig. 248 shows a stack of ultra-lightweight portable belt conveyors. These are light enough to be carried by hand by two men and they are often employed for power

*Fig. 245. T. & T. builders' elevator handling tiles*

presses for discharging work to bins, etc., and for similar inter-process handling duties in machine shops generally. These conveyors are also often mounted on trucks and wheeled carriages and employed in numerous ways to suit the users' exact requirements.

Fig. 250 shows a typical section of T. & T. unit construction trough belt conveyor. This is designed for light duties and is often employed for running conveyor lines across open sites and for construction of movable conveyor lines within industrial premises, etc.

Fig. 251 shows a unit-section T. & T. gravity roller conveyor mounted on adjustable height support stands, this type of conveyor is available in various sizes and may be mounted on wheeled carriages. The previously referred to T. & T. sack placer is designed to enable the discharge end of a conveyor line to be swung through an arc of 100 deg and to be raised or lowered in height through a distance of 2 ft 6 in. It enables transport vehicles, etc., to be loaded directly from the conveyor, hydraulic height control enabling the height of discharge to alter to suit changing loading conditions.

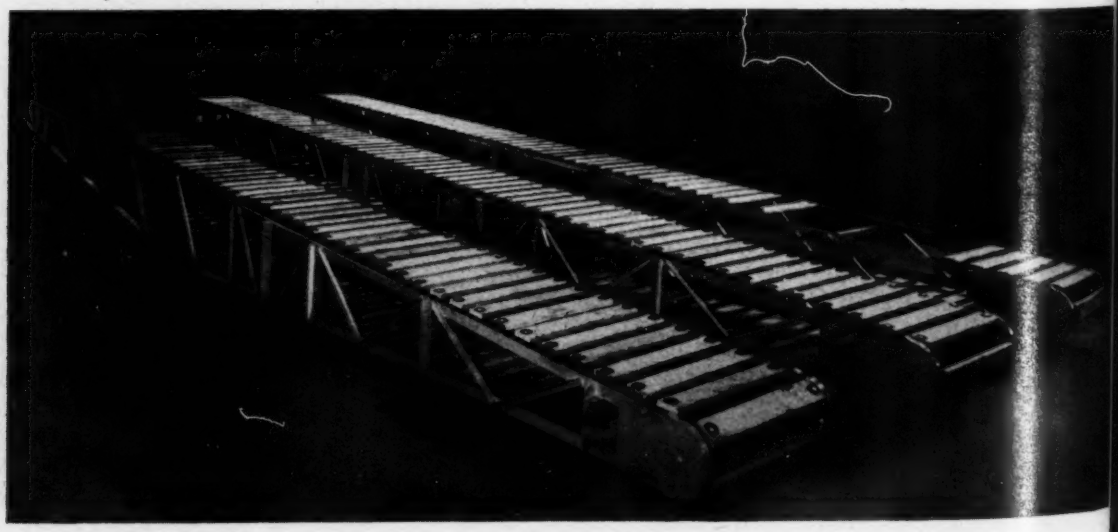
**Other Portable Conveyors**

Another type of ultra-light portable conveyor made by T. & T. Works, Ltd., is illustrated in Fig. 249. This machine weighs 180 lb and may be carried by two men, it has an 18-in flat belt, electric drive and castors and is 20 ft long between centres. This machine is easily moved from point to point and may be used for inclined work as well as horizontal conveying duties. It can, for example, feed materials or items over walls, up to storage bins, etc. Often, a series of such machines is employed, either in series or in parallel. A typical example of application in an unusual setting is in horticulture. Some greenhouses are fitted with a series of such machines in parallel, to enable the soil to be rapidly changed every few months, this being part of the routine of combating soil infection.

**Mobile Conveyors with 'Thorite' Driving Drums**

One of the most recent developments is the availability of 'Thorite' motorized driving drums for incorporation into new T. & T. mobile conveyors. 'Thorite' driving drums are integral conveyor head drums, motors and reduction gearing and are jointly produced by Richards Structural Steel Co., Ltd., and T. & T. Works, Ltd. A range of sizes is available, suitable for belt speeds ranging from 25 ft/min to 250 ft/min, in power ratings ranging from fractional horsepower to 15 h.p. Amongst the advantages gained when a 'Thorite' driving drum is employed on a mobile conveyor are reductions in weight and overall size. Fig. 252 shows a typical 'Thorite' driving drum as applied to a troughed belt conveyor.

*Fig. 246. T. & T. horizontal chain and slat conveyors*



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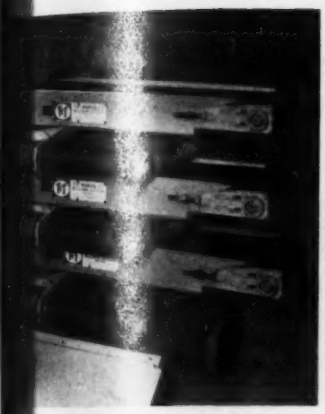

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*Fig. 247. T. & T. mobile drag scraper conveyor unloading coal and stockpiling it*

*Fig. 248. Stack of ultra-lightweight T. & T. portable belt conveyors as used for off-loading power presses and other machines and for truck mounting*

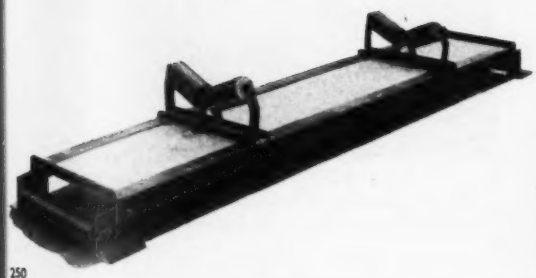

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*Fig. 249. The T. & T. ultra-light portable conveyor*

*Fig. 250. Typical section of a T. & T. unit-section light-duty troughed belt conveyor*

*Fig. 251. T. & T. unit-section gravity roller conveyor with adjustable-height support stands. This equipment can also be wheel mounted*

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*Fig. 252. 'Thorite' motorized conveyor drum, as available for incorporation into new T. & T. mobile conveyors. One advantage is the reduction of weight and overall size of the complete conveyor*

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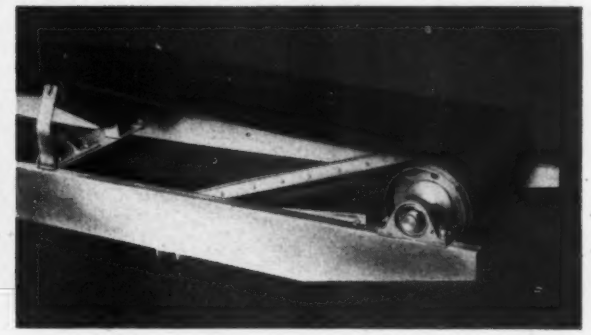


# HANDLING BULLION BY FORK TRUCK

UP TO 20 tons of bullion a day is handled by a Leverstart 'Electromatic' fork lift truck at the London strong rooms of Samuel Montagu & Co., Ltd., bullion brokers.

The fork truck is used for handling bullion to and from road vehicles. Utmost security precautions are taken throughout every stage of the loading and unloading operations.

Outgoing bullion from the strong rooms is brought to the transport department on stillages by Collis hand trucks. Then the fork truck takes over and loads the bullion on to the vehicles. To do this it must first pass through a transport bay, the floor of which rises in a 1 : 10 gradient to street level. The truck is equipped with a specially shortened mast to enable it to pass through a doorway of only 6 ft 2 in headroom between the transport department and the bay. It has also been modified in other respects to make it suitable for negotiating the 1 : 10 gradient under load. In passing through the transport bay the fork truck traverses a narrow passage, 2 ft 10 in wide.

Incoming bullion is also handled by the fork truck, which backs down the gradient with its load.

The 'Electromatic' truck is a model 20v machine, of 1 ton capacity. In view of the need to negotiate the steep ramp fully laden, a 4-wheel drive was recommended by the manufacturers, Leverstart, Ltd., of 185-187 Tooting High Street, London, S.W.17. The additional drive to the front wheels was taken by chain and sprockets through a simple differential gear.

Leverstart trucks have no hydraulics, hoisting of the fork carriage being by means of triplex roller chains and sprockets driven through clutches from the main shaft. Braking is automatic on release of the clutches. The clutch mechanism permits instant forward-reverse change of direction for traction, or raising and lowering of the load.

The truck is on 4-wheels, the rear ones being separated by differential gear articulated to the chassis and turning through 180 deg, permitting the vehicle to be turned in its own length. This, with the small dimensions of the machine, permits of its use in the restricted space available.

*Fig. 1. The 'Electromatic' fork lift truck handles bars of silver from transport department, in background, to road vehicles, via a gradient of 1 : 10*

*Fig. 2. The 'Electromatic' handling silver, with fork carriage raised*

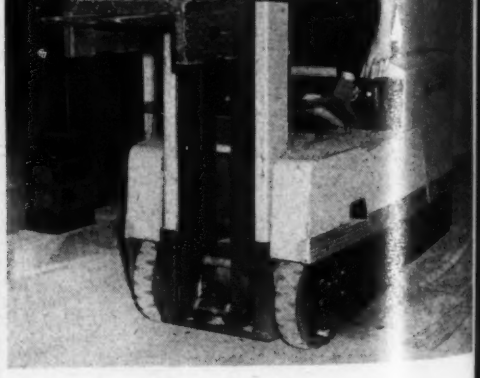
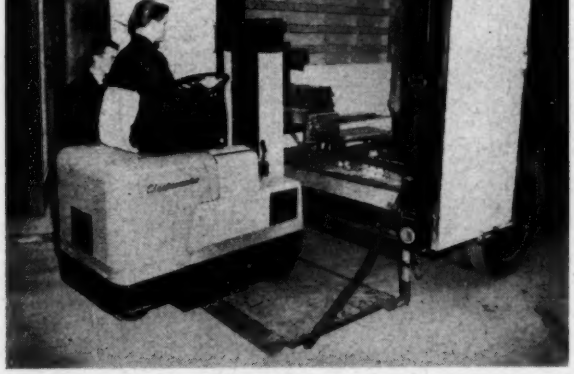


*Fig. 3. A view of the 'Electromatic' fork lift truck loading gold on to a road vehicle*



# PACKAGE HANDLING—PART 2

*Dealing with some typical types of equipment for handling a parcel or object with outer covering, cardboard cartons, wooden cases, bottles, cans or tins; also unit articles such as a loaf of bread, stack of newspapers or periodicals, or cardboard cartons in flat form. The article is based on the author's lecture notes. A future article will deal with Package Handling by industrial power trucks. The first part of the present article appeared in our March issue.*

By J. W. LEECH*

**Chain Apron Conveyors**

*Application:* Chain apron conveyors for packages and individual articles can be made in two types.

As we have just been referring to woven wire belts of the friction driven type we will mention first woven wire belt type apron conveyors.

These consist of two side chains with a woven wire mesh belt between them, some or all of the cross-pins (depending on the mesh of the belt) also pass through the chain. The mesh is therefore an integral part with the chain and mounted on the centre line of the chain which obviates difficulties at the terminals.

This type of apron, as with the friction-driven belts, has a continuous surface which is very advantageous at the feed and discharge points, and by the use of side chains with large rollers it is possible to use this form of conveyor for humpers. The continuous surface is also an advantage on a humper where the inclined section is connected to the feed and discharge ends, which are horizontal, by a curved section.

There is no possibility of items getting trapped at these points as with slat conveyors. Where the apron bends upwards from the horizontal section the tendency to lift can be controlled by putting cover angles over the side tracks above the side chains.

Where cases or cartons have to be taken up steep inclines either angle flights or pusher rollers can be fitted on the face of the belts. Woven wire belts are particularly adaptable to the form fixing of such attachments.

These flights or roller attachments may be spaced apart or fingered so that they can interleave with a take off chute and it is of course possible to get the edge of the chutes much closer to the surface of a woven wire belt apron than can be arranged with the slat type.

Slat apron conveyors carry similar articles, i.e., cases, cartons, sacks, etc.

They can be divided into two main types. Those with the slats spaced apart for fairly large cases or sacks and those which are close pitched which can carry medium sized articles.

*Components:* The slats should be made from hardwood timber well seasoned. Unfortunately it is all too difficult to obtain this to-day.

Alternatively they can be steel slats for narrow conveyors handling light metal parts or steel channels for wide conveyors handling heavy loads.

*British Wedge Wire Co., Ltd. A paper presented to the N.W. Division of the Institute of Materials Handling of which Division Mr. Leech is Chairman.

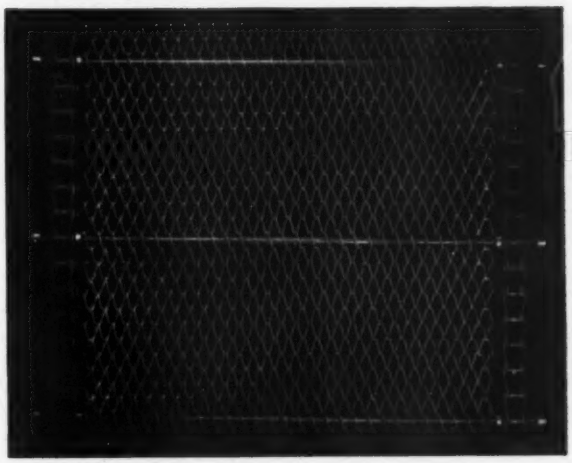
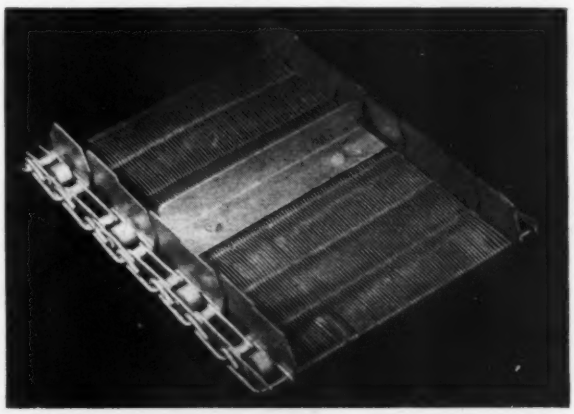


*Fig. 33. Open mesh belt with malleable side chains*

BELOW

*Fig. 34. Close mesh belt with carrier roller side chains, deep side plates and cross-flights*



By fitting the slats so that the face is on the centre line of the chain (this requires special attachments on the chain) it is possible to have the edges of the slats close together so that there is little or no gap at the terminals but because the chain pitch is usually 3 in to 4 in or even up to 6 in there is a

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*Fig.* 35. *FS belt with side chains handling tins of aluminium diecasting*

*Fig.* 36. *FS belt with side chains used on steep humpers and 90-deg bends. Note special roller attachment for handling a wide variety of articles*

*Fig.* 37. *Portable bottom-hinged spaced-slat humper handling sacks*

*Fig.* 38. *Close mesh slat humper conveyor for handling cases*

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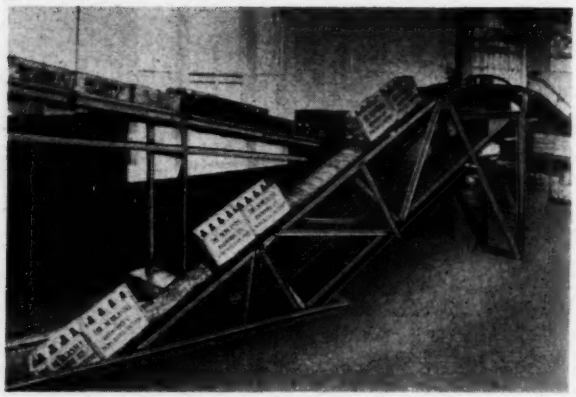

considerable polygonal effect as the slats go round the terminals and therefore gaps are left between the face of the slat and the take off chutes.

For light or moderate loads the chains which connect the slats together and make up the continuous apron need only be bush-type chains of either the steel plate or malleable type.

For narrow conveyors a single chain under the centre of the slats or, for wider conveyors, two chains are arranged underneath near the ends of the slats. With both these arrangements the chains are fitted with attachments on both sides of the length.

With this type of apron the ends of the slats are allowed to slide on side tracks, and it is therefore preferable to fit the end of wood slats with steel tips. For medium to heavy loads two roller chains are used with the slats mounted between them.

The chains are of either the steel plate roller type or the malleable roller type fitted with attachments on one side so that the slats are between the chains, and the rollers are clear to carry the load on suitable angle side tracks both on the top and return side. Channel slats can be used for carrying very heavy loads.

In all cases it is preferable that the angle tracks supporting the side chains should have wearing strips which can be replaced so that the angles which form the main frame of the conveyor do not have to be taken to pieces in the event of wear taking place.

*Capacities:* These conveyors run from a few feet per minute, or even a few inches per minute, up to about 100 ft/min. The usual range is from 20 ft-60 ft/min. and in some breweries slat humpers are handling anything up to 1,800 cases an hour so the capacities are ample for most applications.

*Maintenance:* Chains and all moving parts should be lubricated as usual and the chains should not have excessive lubrication.

Adjustment of the chains may be necessary from time to time but they should not be over tensioned.

*Comments:* Slat conveyors are mainly used instead of belt conveyors for the medium to heavy class of goods although woven wire-belt-type conveyors are now often preferred in view of their many advantages, particularly their strength and the fact that they can be made very wide without any difficulty.

Slat conveyors, however, give very good service over many years provided they are well maintained and compared with the heavier type of belt conveyor their cost is about the same although maintenance costs on slat conveyors usually work out somewhat higher.

**Pallet Conveyors**

*Applications:* Pallet conveyors are single chain conveyors running in the horizontal plane and they can be used for assembly benches, test benches or for heavy work such as carrying foundry moulds around a closed circuit.

One point in their favour is that the whole length of the conveyor can be fully used.

*Components:* As the name suggest they comprise a series of pallets or small table tops connected together, either by a continuous chain mounted underneath the centre of the conveyor or at one side, the chain being run on its side and suitable for gearing with sprockets on the horizontal plane.

Alternatively, the pallets can be connected by pivot links and arranged with a fixed gearing unit under each pallet.

The pallets are supported either side on tracks along which they can skid if light objects are carried or rollers are attached to the pallets to run on the tracks.

With very heavy loads, either the roller race principle described under apron conveyors, or a fixed roller track can be used for supporting the pallets either side of the centre chain.

Drive is by the usual electric motor and gears and can be through a sprocket wheel to the chain installations or by caterpillar drive for dealing with large and heavy loads, the latter being used when the pallets have fixed gearing members.

A caterpillar drive comprises an extra strong endless chain passing round two sprockets at short centres. Teeth are fixed to the chain at regular intervals. These dogs, as the teeth are called, may be of the pivoted or fixed type, their design being dependent on the way the drive is designed for the entry or the exit of the dogs as they engage with the gearing members or chain underneath the pallets.

Tension or adjustment of the circuit is arranged either by screw tension and slide box where sprockets are used or by

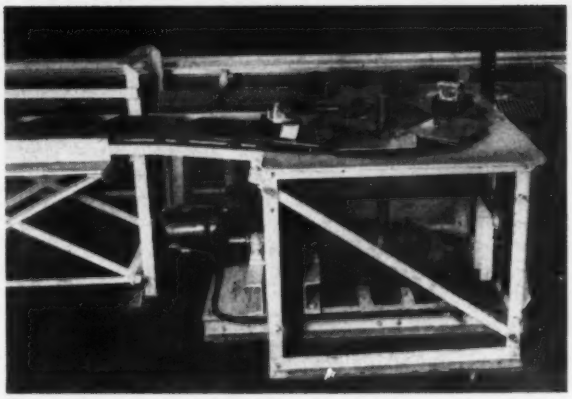

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*Fig. 39. Horizontal pallet conveyor for handling radio sets*

*Fig. 40. Horizontal pallet conveyor for handling foundry moulds*

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movement of the curved track where 180 deg bends occur.

At corners where the radius is large, close-pitched vertical rollers are used to guide the chain smoothly.

*Capacities:* These are slow running conveyors because of the nature of the applications for which they are used but the speed is ample for the output required.

*Maintenance:* On clean jobs lubrication should be applied to the moving and articulated parts and also to all rollers.

On dusty jobs, unless pressurized lubrication is provided and regularly attended to, lubrication should be avoided although rollers can be of the grease sealed type. The treads on all types must be kept in good condition.

The tension of the chain or circuit must be adequate but not excessive as it only adds to the wear if overdone.

*Comments:* This type of closed circuit conveyor is found to be very useful in quite a number of specialized jobs but it is not wide in its scope.

First cost is fairly high and so is the cost of maintenance on foundry and such like jobs but as with all conveyor equipment, if properly used and in the right place, it is well worth installing.

*Fig. 41. Twin chain conveyor for handling crates of beer bottles*

**Twin Chain Conveyors**

*Application:* Twin chain conveyors are used for carrying fairly large sized hard flat-bottomed articles where grease from the chains on the bottom of the items carried is not a detriment.

They are used widely in dairies, breweries and soft drink bottling plants because of their simplicity, but where cleanliness is of major importance the tendency now is to install wire belts or powered roller conveyors for this class of work.

Twin chain conveyors are also used for carrying trays or metal containers handling metal parts or forgings. In this field they are very worth while as they can be used for fairly long straight section conveyors, combined with 90 deg or 180 deg corners, all in one conveyor.

In negotiating these corners there is one difficulty. The outer chain, being longer than the inner one, moves at a slightly different relative speed with the result that the articles are inclined to twist on the corners and require straightening up before entering an elevator or any other interconnected plant at the discharge end.

*Components:* They usually consist of two universally jointed chains running in two tracks. Two side guide tracks are fitted outside the chains.

The tracks on which the chains run are usually channel and the chains are deeper than the sides of the channels so the cases or trays rest directly on the chain and are guided by the side guide angles. The friction between the articles carried and the chains causes them to move along.

At the corners curved angle tracks are used for the chain instead of channels, and these must be kept well greased, so must the channel tracks on the straight section carrying the chain.

This grease is liable to get on the bottom of the articles carried but it also helps in allowing the chains to slide under the article should there be a jam up or should the cases or trays be purposely stopped because the flow of work into the other machines is intermittent.

On the return, chains can be carried on tracks or on flanged pulleys except at the corners where curved angles are always used. Wear treads are fitted on the inside face of the curved angle track at all corners.

Inclines of about 7 deg to 10 deg can be negotiated with this type of conveyor.

Drive is by motor and gears, and the chains gear with sprockets on a common drive shaft. With this type of conveyor, however, the tension shaft is divided in two so the sprockets mounted on these tension shafts can be individually tensioned by screw and slide block arrangement. Single, central chains are sometimes used instead of two chains. In this case the articles mainly rest on the centre chain but may also rest on either of the two side tracks. Therefore, there is almost certain to be some wear on the actual package or case carried.

*Fig. 42. Overhead rail conveyor handling television tubes*

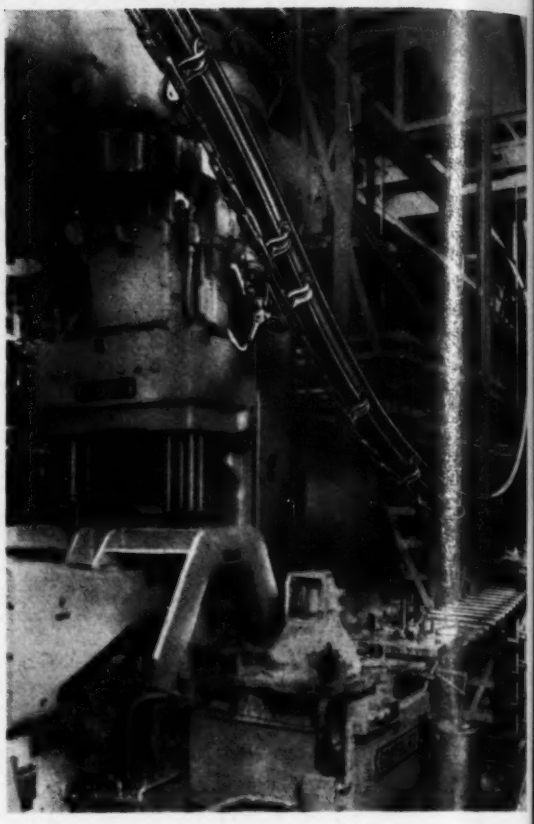


*Fig. 43. Overhead rail conveyor handling jigs for gear cases to and from machining operation at Vauxhall Motors*

*Capacities:* These conveyors can handle considerable quantities of cases or trays and on one installation where the cases are end to end, capacities of between 1,500 to 2,000 per hour have been reached. Speeds up to 60 ft/min. are used although it is more normal and economical from a wear point of view to run at about 40 ft/min.

*Maintenance:* Most wear occurs on the corners so that the amount of maintenance is relative to the number of corners on the installation.

If the tracks and chains are well lubricated and care is taken to see that the right amount of adjustment is applied to the chains, then they give little trouble and wear will only occur over long periods.

*Comments:* These conveyors give good service but the grease on the chains is inclined to collect dirt and deposit it on the underside of the article carried.

They are slightly cheaper in first cost than a belt or chain apron conveyor but maintenance costs may be higher if there are a lot of corners in the layout.

**Overhead Rail Conveyors**

*Application:* Overhead rail conveyors are used for bringing stores to the production line and then connecting machines and processes together and also for storage. If properly used they have the same advantage as pallet conveyors in that every foot of conveyor can be in use at the same time.

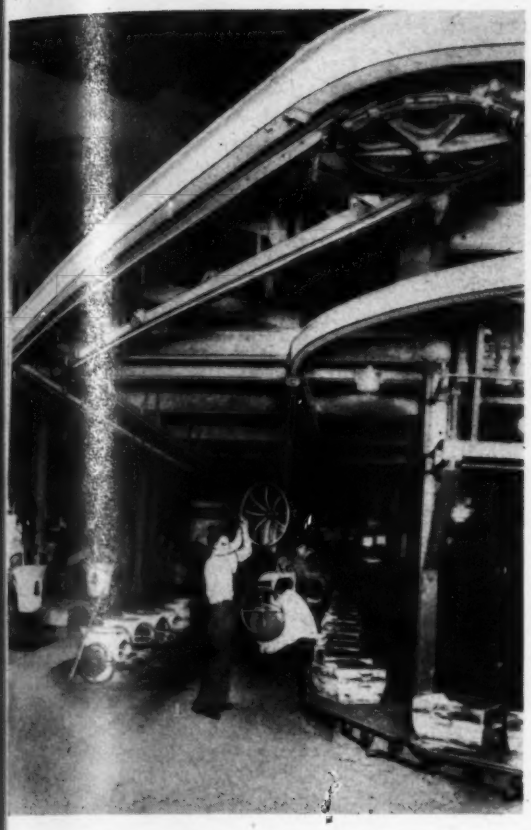


*Fig. 44. Dual-duty overhead rail conveyor; trolleys carrying load are separate from main chain which has pusher*

They are particularly useful in closed circuit processes such as foundry work and assembly lines where mould boxes, formers or jigs have to be brought back to the starting point. They can be constructed so that they are entirely supported from up above and therefore they use little floor space. On the other hand, the roof space, which is otherwise useless, can be employed for storage or processes such as enamelling ovens.

They are used in abattoirs and other food factories, in the manufacture of radio and TV sets, refrigerators, electric motors, washing machines, the clothing industry, not to mention the aeroplane and car factories and many other industries besides.

Next to belt conveyors they are probably the most widely used form of multi-purpose conveyor for handling the unit articles.

*Components:* They comprise a track which consists either of an I beam joist or angles or maybe channels on which two- or four-wheeled trolleys are run.

The rollers of the trolleys should have grease-sealed ball or roller precision bearings of good class and, where necessary, the roller tread should be tapered to suit the track.

The trolleys are connected together underneath the track by a wire rope or a chain. A wire rope will, of course, flex in all directions and if a chain is used it is usually one of the universal as in the case of the Webb or Keystone link chain.

The latter type of chain is very rugged and strong and easily assembled as the pins are detachable by concertinaing the links.

The tracks carrying these rollers can be horizontal or have upward or downward bends or inclines.

The carriers on which the loads are placed are hung below and attached to the chain and trolleys or they can be supported by separate trolleys running along separate tracks. In the latter instance dogs or pusher attachments are fitted to the trolleys connected by the chain. This type of conveyor is sometimes known as a dual-duty conveyor and is useful where the side tracking of goods into storage bays or into refrigeration plants is carried out, as in abattoirs.

The tracks in these side bays or storage racks can have their own powered pusher conveyor if necessary or they can be of gravity rail on to which the trolleys run and at the far end of the rail a pneumatic or hydraulic lifting gear can be fixed so that the track can be lifted up and the trolleys fed back on to the main conveyor track when required for circulation.

A third use for overhead conveyors is as a tow conveyor where the carriers are wheeled floor trolleys with a stayrod in front for attaching to suitable tow attachments on the overhead chain and trolleys.

Where the path of the conveyor passes round corners in the horizontal plane, sprockets can be used, or more often the roller bends comprising a series of close-pitched vertical rollers in a channel guide. These rollers must be of a heavy duty type, grease-sealed and mounted on robust spindles.

Motive power to this type of conveyor is by the usual electric motor and gears and on long installations fluid couplings are included so as to help in starting up.

For driving chains, sprockets can be used at corners where there is a 180-deg lap. More often, however, caterpillar drives are fitted on straight sections of track. These have already been described.

On long conveyors several caterpillar drives may be used, each of them mounted on a floating frame. In this case the driving gears incorporate a variable-speed gear fitted with a rack and pinion, the rack being on the fixed frame and the pinion being on the variable-speed gear and mounted on the floating frame.

The floating frame is mounted against coil springs and as the load varies the springs are depressed or extended. This rotates the pinion on the rack and either speeds up or slows down the gear. In this way the amount of pull taken by each drive is evened out without the necessity for synchronized motors.

Limit switches placed behind the floating frames cut out all the drives if one is overloaded. Whilst total horsepowers of this type of conveyor may often be high because of the length of the conveyors used, generally speaking the horsepower per ton is low for the amount of work they do going up and down inclines.

To avoid slack in a chain after a drive it is preferable to try and arrange that a fall in the track occurs immediately following a drive. In this way chain adjustment assemblies, if required (and they are not always necessary) can be placed in accessible and convenient places.

*Capacities:* It is not usual to run these conveyors over 60 ft/min. Most of them run at only a few feet per minute up to 10 ft or 20 ft/min. If they are run too fast, the carriers, particularly if they are long ones, swing out at the corners. The output is based on the spacing of the carriers at the speeds to suit the particular application.

*Maintenance:* Provided a good class of roller and bearings are used little maintenance is required on overhead rail conveyors except at the drive and tension points or at the horizontal corners.

Most of the maintenance is on the carriers themselves and where these are jointed to the trolleys or chain, as they must be kept in good condition and free to swing. Where automatic pre-determined feed and discharge is used the electrical or mechanical mechanisms will require keeping up to scratch.

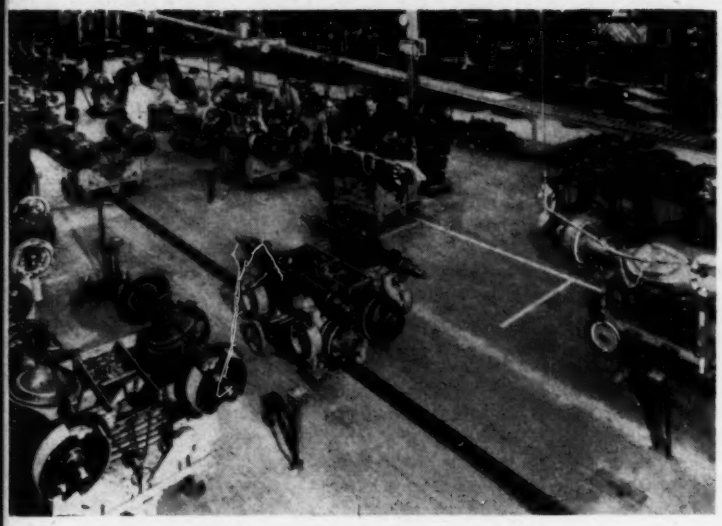
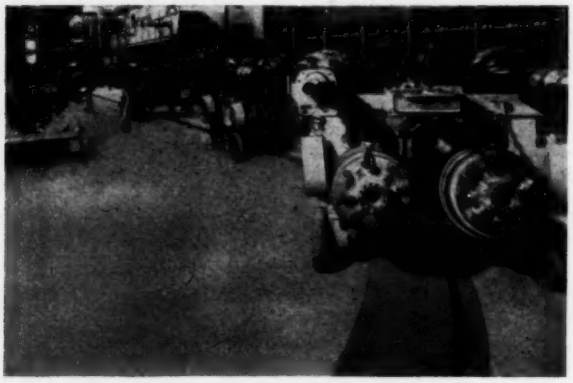


*Fig. 45. Underfloor conveyor*

BELOW

*Fig. 46. Underfloor conveyor showing close-up of trolley carrying 2-ton load of unassembled parts*



*Comments:* In my opening remarks on this type of conveyor I have already tried to give the impression that I consider it to be one of the most universally useful in the industry.

The cost per foot run will vary with the load and size of article carried but these conveyors are made from the cheapest and lightest arrangements up to very heavy installations and whilst the first cost may appear to be high they will soon repay for their installation if properly and fully used.

**Underfloor Conveyors**

*Application:* Underfloor conveyors are sunk in the floor. They are used for main storage conveyors and for taking stores to assembly stations or for collecting pallets from several stations where loading has taken place as they can wind their way in and out of loading positions to the warehouse.

In the warehouse they can be the main circuit for taking the pallets near to the positions where the lift trucks are operating. This in fact was done with a system put in at Burtonwood aerodrome handling parts for the American Air Force repairs.

Their main advantage is that there is no obstruction above ground so the trolleys can be run over the top of tracks if required.

*Components:* Retractable tow pins are fixed to the front of the trucks and are dropped into the slot in the floor. The chain is fitted with pusher attachments which pick up these tow pins. These pusher attachment links are also fitted with four-wheeled ball bearing roller trolleys which are somewhat similar to those used on overhead rail conveyors and they run in tracks below the floor. Once the tow pin is engaged away goes the loaded truck up hill and down dale if necessary.

*Capacities:* Heavy loads can be dealt with. In one case 24 loaded trolleys are carried on a circuit of about 308 ft at a speed of about 12 ft/min, the load in each trolley being 2 tons in weight. Constant stops and starts take place at the assembly bays.

*Maintenance:* In spite of these constant stops long life and good service can be obtained with small maintenance cost provided the chain is kept well lubricated and adjustment is attended to from time to time.

*Comment:* First cost of the installation is moderate and compares very favourably with that of an overhead rail conveyor.

**Chain Elevators**

*Application:* Chain elevators are used for the continuous elevating of packages and articles as opposed to intermittent hoists or lifts.

They may be vertical or inclined and to obtain the highest speeds the articles carried on any one installation should be uniform in size with automatic feeding, although hand feeding is more usual.

*Components:* Most chain elevators consist of two endless chains running over head and tail sprockets. The carriers are swung between the chains from pivot pins bolted to the chains.

Alternatively stabilized trays can be used. In this case the pivot pins are in the sides of the trays which fit into the chains and a weight is fitted under the trays to stabilize them and keep them the right way up.

A more rigid form of stabilization can be with one of the pivot pins passing through the chains to which is fitted a crank arm and a roller which runs in a separate set of guide tracks.

A further more robust method of fixing trays to a chain is to stagger the two chains and fit the spigot pins to the trays at diagonally opposite corners. This method is

*Fig. 47. Swing tray elevator*

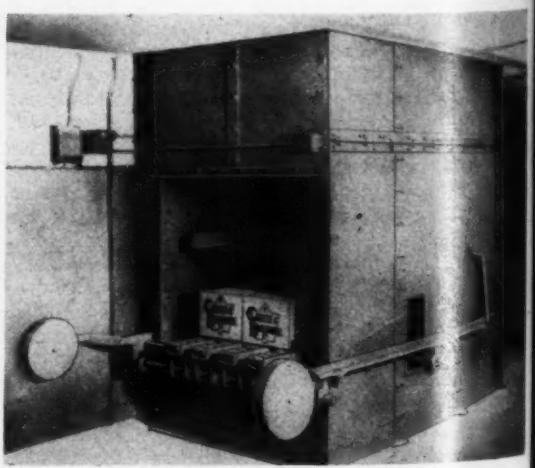
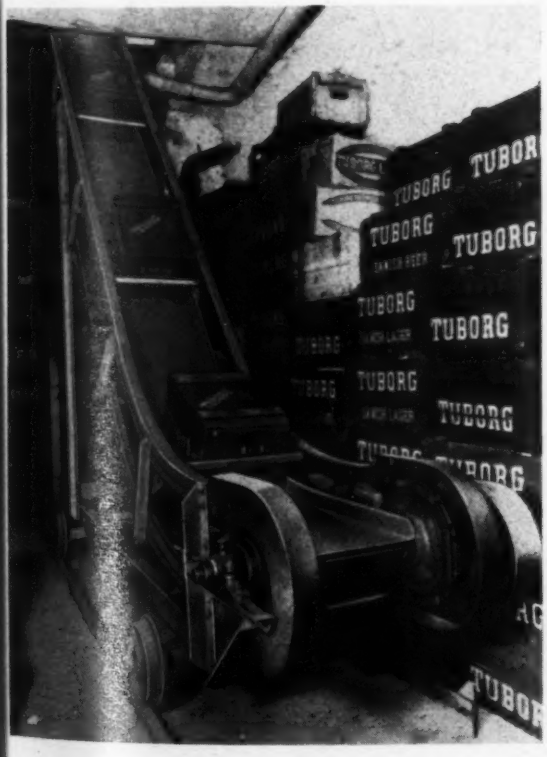


*Fig.* 48. *Fixed arm elevator*

*Fig.* 50. *Push-bar elevator for crates*



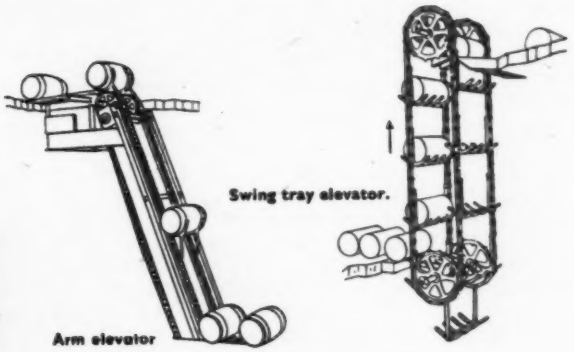




*Fig.* 49. *Diagram of fixed arm elevator and swing tray elevator*

recommended where it is important that no swinging of the loads takes place as it goes over the head sprockets.

I know of one installation in a photographic factory where tins with semi-circular bottoms are carried by this type of elevator with automatic feed and discharge and they are filled almost to the top with a liquid gelatine solution. The installation has been entirely satisfactory in avoiding all spillage.

The next most common arrangement is known as the fixed arm elevator where the arms are fixed to the two chains. These arm elevators are usually inclined and can be used to handle barrels, drums, bundles of cloth and other cylindrical objects as well as cases.

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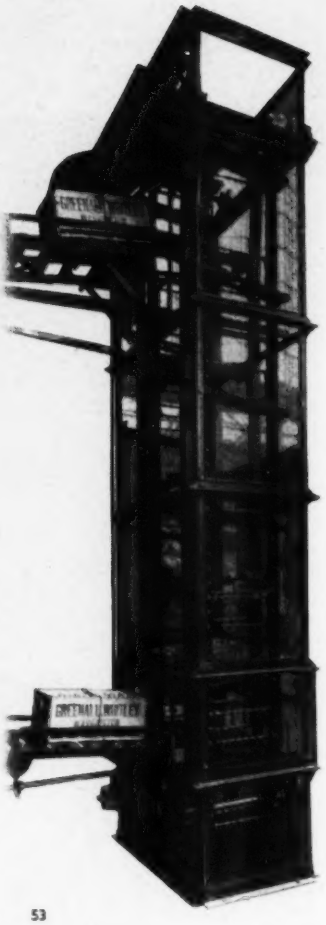

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*Fig. 51. Push-bar elevator for sacks—feed end*
*Fig. 52. Push-bar elevator for sacks—discharge end*
*Fig. 53. Twin-lift elevator*

There is also a twin-lift type of elevator which consists of four chains, each pair of chains being connected together by flights which project inwards. The cases are fed in sideways between the two sets of chains and the flights pick up either side of the case. This unit gives high capacities and it is easily fed and discharged automatically.

*Capacities:* In general, capacities for elevators can never be as high as a continuous flow on a belt conveyor because of the intermittent loading which is necessary.

Swing tray elevators are not usually run much above 60 ft/min, at which speed the maximum number of loads per hour at which it can be carried is round about 420.

Arm elevators usually run at about 40 ft/min, at which speed capacities are round about 4/min or 240/hr.

Twin-lift elevators have been run up to about 700 loads/hr, but to obtain these speeds absolute uniformity of load and a load which is not too deep is essential. It must also be a load which will quickly discharge at the top.

*Maintenance:* At the comparatively slow speed at which they run maintenance costs are not high and the main points of wear are the pivot points where the carriers are attached to the chain. Regular attention should also be paid to automatic feed and discharge mechanisms.

*Comments:* The first cost of most vertical or inclined chain elevators is relatively high, but they are very effective in taking up a minimum of floor space which often represents productive capacity and so must be considered where operating area is restricted.

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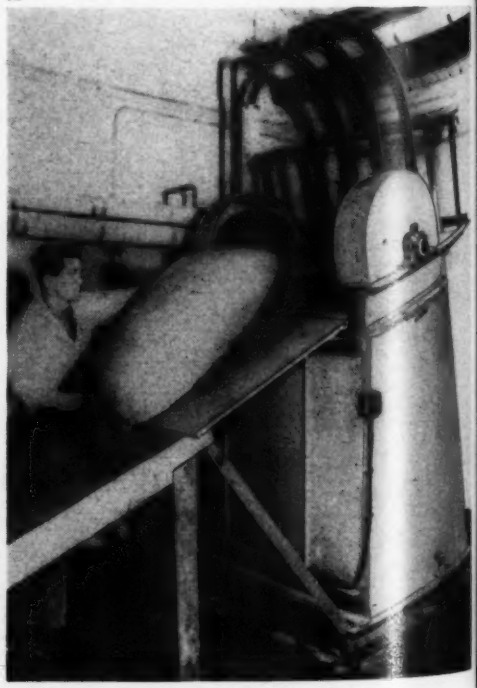


# CORRESPONDENCE

## B.I.T.A. STABILITY TESTS

*To the Editor, 'Mechanical Handling'*

Dear Sir,

Mr. Mundy's letter, published in your February issue, emphasizes that many users remain to be convinced that Test No. 1 of the B.I.T.A. Stability Tests for fork lift trucks provides an adequate margin of safety.

Mrs. Mumby rushed to the defence of the I.T.A. tests in general but failed, I submit, to deal adequately with this specific point.

The I.T.A. tests are such an improvement on previous criteria of stability that enthusiasm is understandable, but it would appear desirable to study the criticisms of users here before following the American lead without reservation.

The mathematical analysis upon which the I.T.A. tests were based was very much simplified. A more rigorous treatment would have rendered the analysis impracticably complex, but nevertheless important factors were omitted and the results are approximate. For the lateral stability tests, this approximation is probably sufficiently exact, but it would appear at first sight that the omission of these factors (such as the mast deflection under the forces introduced by the dynamics of the load) might be enough to invalidate the calculations for Test No. 1.

Being responsible for the stacking of Service explosives on a very large scale, I find this question of more than theoretical interest.

Looking at it practically, the condition of using a truck with forward mast tilt, and the load fully raised, should not be compared with cornering a Citroen car 'at full speed with the body raised to maximum height'. On the contrary, it is a normal working condition of the truck when stacking a top tier of post pallets. Such an operation calls for a degree of concentration sufficient to distract the driver from the stability 'feel' of his truck, and the danger of overturning, if the truck became unstable, would thus be very real.

A 4 per cent tilt on the test table, even with the rated load in its highest *and the mast in its forward working position* would appear to provide a none-too-generous margin of stability to cover actual contingencies such as uneven floors, 'inching' accelerations, whip of mast, etc., without considering the unforeseen. The test *with the mast vertical*, however, would appear to cut this margin to a dangerously meagre figure.

I feel that many users would like to see a demonstration of a truck (with, say, 14-ft mast) whose longitudinal stability was just acceptable under the I.T.A. test, to indicate clearly what percentage over its rated load such a truck can handle on level ground under the extreme working conditions referred to in paragraph 6 above.

Yours faithfully,

W. B. WINSOR,

*Armament Supply Department, Admiralty Offices*
*Ensleigh, Lansdown, Bath*

*Mrs. Mumby replies:*

Having, as Mr. Winsor remarks, rushed to the defence of the I.T.A. tests and no other and more competent champion having come forward, I find myself in the embarrassing position of being unable to withdraw from the affray.

Mr. Winsor goes to the crux of the controversy. With many other important users, he is concerned to be on the safe side of safety—and rightly so. He is dealing with dangerous material. He can afford to pay an extra premium for extra safety and would, again quite rightly, consider himself justified in doing so. If no other factors were involved, his criteria would be good for all users; they would all be well served by standards loaded toward safety.

But other considerations are involved. The fork lift truck is a world commodity. British fork trucks are sold abroad and trucks built abroad are sold here, together with trucks designed abroad and manufactured under licence in this country. British trucks, therefore, must be competitive in such matters as price, manœuvrability, and space-economy. For these reasons alone, and there are others, an international standard is essential.

I am not suggesting that British users should accept a standard that cannot be justified on the basis of safety. What I am suggesting is that they should accept a standard that is safe, but not safer than safe. And here, of course, we return to the recurring question: does Test No. 1 establish safety?

Mr. Winsor raises some pertinent points that I cannot presume to answer; I can only set down my own observations.

1. When stacking a top tier of post pallets, the degree of concentration required is sufficient, he says, to 'distract the driver from the stability "feel" of his truck'. This operation is, of course, a crucial test of skill, but many experienced drivers have assured me that they could not fail to sense rear-axle buoyancy in ample time for corrective action to be taken.

2. The operation suggested in Mr. Winsor's final paragraph was included in the demonstration of test procedures (reported in *Mechanical Handling*, December, 1958, page 811). Post pallets were tiered on level ground and my impression was that the truck was slightly overloaded, though no attempt was made to obtain evidence of a percentage overload. On being subjected immediately after the demonstration to Test No. 1, the truck just scraped through. Height of mast was immaterial in this context, since the full rated lift-height was used.

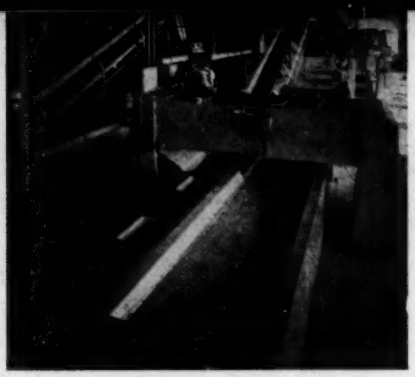
3. In the matter of contingencies, the fact that the test is based on empirical findings must surely imply that it covers all normal operational risks. And, incidentally, in my Citroen analogy I was not contemplating the normal working conditions to which Mr. Winsor refers, because Test No. 1 *does* satisfy such conditions. The comparison was with the unspecified abnormal conditions implied in Mr. Mundy's demand for 'inherent' stability under any loading, with full lift and forward tilt.

On the general question, I would like to raise two further points.

1. No tests could measure the full value of competent design. When all possible care and ingenuity have been devoted to the devising of safety standards, there remains no better insurance than a machine that is smooth in all its actions, possessed of good manœuvrability and visibility, and capable of being driven for long periods without strain.

2. In the travail of determining the ideal universally acceptable formulae it is easy to overlook the primary function of a standard. Essentially it is a yardstick or a basis for comparison, and the requirement of a good standard is that it shall be understood and accepted by all concerned. Hence the importance of a common clearly defined international standard. If the B.I.T.A. standard is also the I.T.A. standard for America and the F.E.M. standard for Europe, and if it states clearly that trucks conforming to it are stable under specified conditions, then users know precisely where they are. They can compare the products of one manufacturer and one country with those of another.

Users handling dangerous materials or operating under adverse site conditions or training their drivers, and for these or other reasons wanting to be on the safe side of safety, can derate their machines accordingly.



*View of the salvage floor, showing the recovery conveyor and magnetic separator*

# GLASGOW'S NEW REFUSE DISPOSAL WORKS

A NEW refuse disposal works, the largest of its kind in Britain, was formally opened at Polmadie Road, Glasgow, recently.

The new works, built on a 22-acre site, is estimated to have cost £1,668,000. It comprises the refuse disposal works itself (£1,250,000), a garage (£70,000), a vehicle repair workshop, lubrication block, washing stance, petrol and diesel installations and equipment (£108,000) and an amenity block, boiler house and engineer's house (£160,000). A further £80,000 is estimated to have been spent on site development, including the purchase of the ground and provision of roads, footpaths, etc.

The actual refuse disposal plant comprises four independent sections with a total handling capacity of 400 tons of crude refuse per eight-hour shift. Under normal working conditions only three of these sections are used, together handling 300 tons per shift; the remaining quarter section acts as reserve capacity for peak load conditions and enables any necessary maintenance to be carried out in normal working hours. Two shifts are worked each day, and provision is also made for the direct incineration of 20 tons of trade waste per day.

The main plant is housed in one symmetrical building block, the reception bay, on the second floor, being entered from an inclined approach road.

Refuse is automatically delivered into the furnaces and clinker is mechanically discharged from the grates, quenched and conveyed by hoist to an overhead bunker.

The Polmadie Road Works was built to a general specification prepared by Glasgow Corporation's Director of Cleansing (Mr. P. D. Fairlie, F.Inst.P.C.) in collaboration with the City Architect (Mr. A. G. Jury, F.R.I.B.A., F.R.I.A.S., F.R.S.H.) and the Consultants, Merz & McLellan of Newcastle-upon-Tyne.

The main contractors were Heenan & Froude, Ltd., of Worcester, who were responsible for all detailed design and technical data, the manufacture and erection of the screening and salvage house machinery and the complete refuse disposal handling plant, including the mechanically operated furnaces and their accessories, such as the clinker crushing and grading plant, baling presses and the like.

## BOOK REVIEW

**HEALTH IN INDUSTRY.** Donald Hunter, C.B.E., M.D., F.R.C.P. Published by Penguin Books, Ltd., Harmondsworth, Mddx. Price 4s.

*Specially reviewed for Mechanical Handling by a Lecturer in Occupational Health.*

Health is a necessary ingredient of prosperous industry and, in human terms, can make the difference between a life of happiness and one of drudgery. Disease, whether or not it is directly caused by a man's work, will affect his working capacity. Unfortunately, the value of health to an individual may only be recognized when it has been lost and a young person is more often interested in the maintenance of his television set or car than of his own health. However, by controlling the environment a great deal can be done to prevent disease and promote better health.

The major practical results in the fight against disease have in the past derived mainly from community health measures, of which we are often only remotely aware. The supply of pure water and food, and the safe disposal of sewage have had a tremendous effect on our health and we can look forward to a further improvement when we have clean air to breathe. Just as the inhabitants of a town may benefit from such environmental improvements, so may the inhabitants of a factory derive benefit from an improved environment within the factory.

It has long been known that some occupations are especially hazardous and associated with specific diseases. As these hazards are recognized and dealt with so new ones arise in connection with new processes. The complexities of industry to-day are such that the forecasting of hazards, their early detection and elimination, may call for the combined skills of doctors, chemists and engineers.

The amount of time lost annually to industry from sickness due to those diseases caused by work is between 1 and 2 million man-days. Accidents at work cause a further 18 million man-days absence, while all other illnesses cause about 280 million man-days to be lost each year. The cost of disease or the value of health to industry is therefore obvious.

Health in industry in its widest sense is therefore a large subject embracing many technical fields. Any endeavour to compress it all into less than 300 pages and present it in a form which is comprehensible and interesting to people with widely differing background knowledge is fraught with difficulties. Donald Hunter is a famous toxicologist and 'Health in Industry', which is written with infectious enthusiasm, is written from the point of view of a medical specialist.

The book starts with an interesting account of the background to industrial medicine as it is known to-day. The working conditions in mines in ancient Egypt and in Europe in the Middle Ages are described. The part played by great medical men such as Hippocrates and Ramazzini in unfolding the nature of illness and its relation to work is told. The effects of the industrial revolution on the health of the worker in this country are described and the story of the development of legislation concerning factories, industrial injuries and disabled persons is recounted. An interesting chapter on accidents in industry and in the mines, how they are caused and some methods of prevention follows.

A large section of the book is devoted to description of poisoning by various metals and organic compounds. The physical and chemical properties of these substances are given and the reader is told why and where they are used. The symptoms of the illnesses which they may produce are described together with some aspects of treatment. The measures that may be taken to prevent these conditions are also outlined.

The dust diseases of the lungs are then described—silicosis, coal miners' pneumoconiosis, asbestosis and

byssinosis. The last chapter is devoted to a miscellaneous collection of diseases—including anthrax, miner's nystagmus, injuries from radioactive substances, diseases of the skin and some forms of cancer, all of which are related to specific occupations.

Dr. Hunter is to be congratulated on presenting such an interesting account of the diseases of occupations in a manner that can be read and understood by many people without previous medical training. It is a pity that though the prevention of individual diseases is described the principles underlying the techniques of prevention are not. The design of machinery in relation to its operator, the control of the environment and the organization of medical services in large and small factories, that might bring about an improvement in health far greater than the elimination of specific industrial diseases, are inadequately dealt with. Let us hope that a companion volume to the present good start will carry the story of health in industry a little further.


## MAY

*The above issue will contain, amongst others, the following articles:*

**Raw Materials Handling at Ravenscraig Steelworks**

**The Automatic Facing of Letter Mail—Part II**

**and usual features**


# NEWS OF PERSONALITIES

The General Electric Co., Ltd., announce the appointment of two new directors to the Board. The **Hon. S. G. Catto,** of Morgan, Grenfell & Co., Ltd., merchant bankers and **R. N. Millar, M.A.(Cantab)., B.Com., M.I.Mech.E., A.M.I.E.E., F.R.Econ.S.,** who is responsible for the G.E.C.'s nuclear energy and heavy engineering establishment at Erith.

Power Jacks, Ltd., will now operate again from Valetta Road, Acton, London, W.3, and will be entirely self-contained. It will have its own manufacturing, engineering, accounts and sales departments, all operating from this address. The Newton shock absorbers and clutch plates will also be manufactured and sold from the same factory. **F. J. Fagard, A.M.I.Mech.E.,** has been appointed managing director.

Lansing Bagnall, Ltd., of Basingstoke, announce the appointment of **Peter Boulton** as their general manager.

Mr. Boulton, who was formerly managing director of Brades, Nash & Tyzack Industries, Ltd., of Oldbury, took up his new appointment on March 1st last. Mr. Boulton will also control the management of the associate company, Messrs. J. E. Shay, Ltd., precision engineers and makers of the Rotogardener/Rotoscythe range of mechanized horticultural equipment.

Mackay Industrial Equipment, Ltd., have recently appointed W. **Gay** as their technical representative for the northern counties.

F. E. Weatherill, Ltd., of Welwyn Garden City, loading-shovel manufacturers, announce the appointment of **V. J. Garner** as sales manager. Mr. Garner was previously assistant sales manager, a post held for 2½ years, and before that a technical representative for the company in the Midlands. Behind him altogether he has 10 years' experience in the field of loading shovels.

**G. M. Warren,** sales director, Aveling-Barford, Ltd., manufacturers of road-making and earth-moving equipment, left recently to visit Aveling-Barford Group subsidiary companies in Venezuela and Canada. Whilst overseas he will call also upon customers and distributors in Trinidad, Panama and Mexico.

During the past 10 years the Group has built up extensive interests in the Canadian and Latin-American markets which have come to occupy a major position amongst the Group's world-wide markets.

**John Stokes** has been appointed managing director of Bagshawe & Co., Ltd., of Dunstable, conveyor and chain manufacturers. He joined the company five years ago as general manager.

Previously, Mr. Stokes was with Qualcast, Ltd. He takes over the position of managing director from **Albert James Flynn,** who retired at the end of last year after 40 years' service.

British Northrop, Ltd., of Blackburn, announce the appointment of **J. E. T. Watson** as general sales manager of their construction equipment division.

It will be recalled that British Northrop, Ltd., recently acquired Chaseside Engineering Co., Ltd., of Hertford—a greatly respected name in the British loading-shovel industry —with whom Mr. Watson served as sales manager for a number of years until 1953.

British Northrop, Ltd., add that this new appointment is due to the broadening of the activities of the company.

**G. H. Sugden, C. H. Wooll, E. G. Liebert** and **J. R. Rowlands** have been appointed directors of Henry Simon (Holdings), Ltd. **C. G. Ahlquist** and **C. W. Jones** have been appointed directors of Henry Simon, Ltd. **P. W. R. Jolley** and **L. Haines** have been appointed directors of Simon Handling Engineers, Ltd. **F. B. M. Austin** has been appointed managing director of Henry Simon (Australia), Ltd., with effect from March 1st, 1959, in succession to **K. R. Brocklehurst,** who will remain chairman of the company.

*F. J. Fagard*

*J. R. Rowlands*

*P. Boulton*

*W. Gay*

*V. J. Garner*

# REVIEW OF NEW EQUIPMENT

## BRAKED AND DIRECTION-LOCKED CASTOR

Users of many types of castor-wheeled trucks and other handling equipment will appreciate the value of one of the latest productions of Autoset (Production), Ltd., Stour Street, Birmingham, 18. This is a manually expanding braked castor with directional locking. It has a brake-operating rod through the pivot spindle to actuate a bell-crank lever, the remote end of which is connected to an auxiliary lever attached to the brake lever. Ferodo-lined expanding brake shoes housed in the wheel can be adjusted for clearance by an arcuate slotted quadrant. Directional locking is by a vertical spring-loaded tommy bar, the lower end of which engages in holes equally spaced in a horizontal circular plate forming part of the castor fork head. Tapered roller bearings are used in the swivel housing and wheel hub.

*A ½-ton capacity Autoset braked and direction-locking castor*

*A Michigan tractor equipped with the makers' new backhoe excavator attachment*

The operating rod through the pivot spindle to lock the brake may be pulled up or pushed down according to the type of chassis to which the castor is attached. The castor may be locked in eight different directions. Malleable castings are used for the vertical sideplate head, castor fork and bell-crank lever. Mild steel rubber-tyred wheels are used for braked castors and cast-iron rubber-tyred wheels for those with only direction location. Solid rubber tyres are of 65-70 degrees Shore hardness, and anti-static if required. They have a dynamic capacity of 20 cwt, but if the castor assembly is fitted with an iron wheel, the dynamic capacity is 30 cwt.

## BACKHOE ATTACHMENT FOR TRACTOR SHOVELS

A backhoe attachment mounted on the three Michigan tractor shovels, models 75A, 85A and 125A, is the latest development announced by Michigan (Great Britain), Ltd., 3, 4 and 5 Charles II Street, St. James's Square, London, S.W.1. Simultaneous movement of boom and bucket can be made with ease, simplicity of control, already a feature of the tractors, being maintained in the backhoe attachment. One lever hydraulically controls the boom action and one the bucket action. Individually adjusted outrigger feet will level the machines on slopes up to 15 deg. The backhoe has travel speeds up to 27 m.p.h. and will operate over rough terrain.

A series of alternative bucket sizes from 12 in to 36 in wide and designs including trench buckets, bellhole buckets, grave and ejector buckets allow a variety of usage. The Clamshell bucket, also available, is specially designed for digging straight-sided permit or bellholes, allowing down pressure as well as forward pressure for undercutting. All buckets can be exchanged on sites in less than 30 min. In addition, the standard range of Michigan front-end attachments are available, including a filler blade, fork lift, scarifier, crane hook, as well as heavy- and light-duty buckets, all interchangeable.

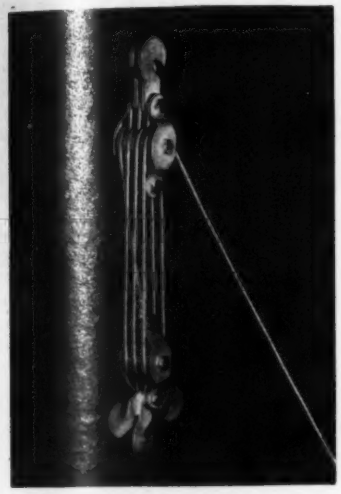
*R. & M. ball bushings designed only for linear motion*

## BALL BUSHINGS FOR LINEAR MOTION

The many well-known advantages afforded by the use of ball and roller bearings to reduce friction, wear, loss of alignment, chatter and maintenance costs on rotating machinery parts are now available to British industry as applied to linear motion by the introduction into this country of ball bushings. As already widely used in the United States, the sole manufacturing and selling rights for these in Great Britain and the Commonwealth, excepting Canada, have been acquired by the Ransome and Marles Bearing Co., Ltd., Newark-on-Trent.

Designed only for linear motion, these bushings contain three or more ball circuits round which the balls rotate as in a conventional ball bearing. Some of the balls carry the load in one portion of the circuit whilst the unloaded balls

continuously recirculate back to the starting point in a retainer. There are no loose parts, and each ball bushing forms a compact assembly which can be handled as a unit. Available in eleven shaft sizes ranging from 1 in to 4 in with corresponding outside diameters from ¼ in to 6 in, ball bushings are as easy to fit as plain bearings, which they can often replace, require no complicated lubrication systems and their low coefficient of friction is hardly affected by changes in load or lubricant viscosity.



*The Haltrac nylon cord midget hoist*

## POCKET-SIZE MIDGET HOIST

A wide variety of uses can be found for the new Haltrac midget hoist, which is tested to lift 1,000 lb though it weighs only 1 lb and can be carried in the pocket. It is produced by Haltrac, Ltd., Bourne Works, Weimar Street, London, S.W.15.

Made of aluminium, combining strength and lightness, it has a 72-ft rot-proof nylon cord and self-lubricating solid nylon pulley wheels. The entire unit is thus rust-proof. As the load is evenly distributed over the seven strands of nylon cord, the combined breaking strength is over 1,200 lb. It has multi-locking hooks to act as a self-locking unit which can only be opened when the weight is released.

## ELECTRIC PLATFORM TRUCK

One of the latest additions to the range of products of A. Hirst and Son, Ltd., Crescent Works, Meadow Lane, Dewsbury, is the Forager battery electric truck of 2,000 lb capacity. It is driven, through a worm gearbox and duplex chain, by a traction motor taking current at 24-V from a battery of 105 amp-hour capacity at the 5-hr rate. A wall-mounted automatic charger is supplied. The controller gives three forward and three reverse speeds from 1½ m.p.h. to 4 m.p.h.

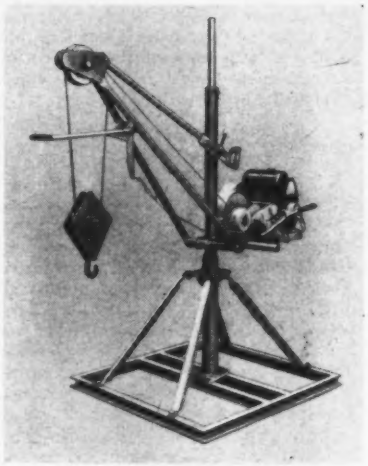
Fitted with 7½ × 3-in solid tyres, the rear driving and steering castor wheels are mounted and pivoted on taper roller bearings and have a 180 degree steering lock. The front wheels have 6 × 5-in tyres and roller bearings. A transmission brake is operated by control handle. The platform measures 60 × 36 in and is 6½ in from the ground with 1½ in under clearance.

## HAND PALLET TRANSPORTER

Another new production of A. Hirst & Son, Ltd., is the Forager 1-ton transporter for all pallets from 30 in to 54 in wide. With overall length of 4 ft 8¼ in, overall width of 3 ft 8 in and width inside arms of 3 ft 2 in, it is carried on three 8 × 2-in solid iron wheels running on roller bearings, the steering wheel being pivoted and fitted with a hinged steering handle. The lifting forks are raised by a hand-lever-operated hydraulic pump from a height of 2¼ in to 6 in. They measure 3 × 1¼ × 30 in long and the fork centres are adjustable from 11 in to 21 in.

## PORTABLE MIDGET HOIST

Designed for easy handling of bricks, mortar, beams, tiles, asphalt and roofing materials in the building trade, the latest ACE midget hoist is adaptable for operation on scaffolding or can be mounted on an independent base stand. For jib duty, at radius variable from 3 ft 6 in to 5 ft, the maximum load is

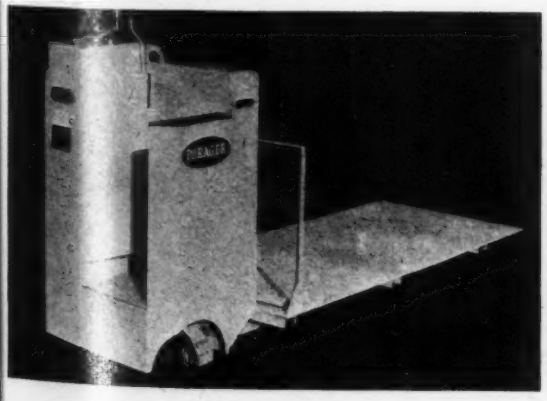


*For handling builders' materials the ACE portable midget hoist can be mounted on an independent base stand as shown above or on scaffolding*

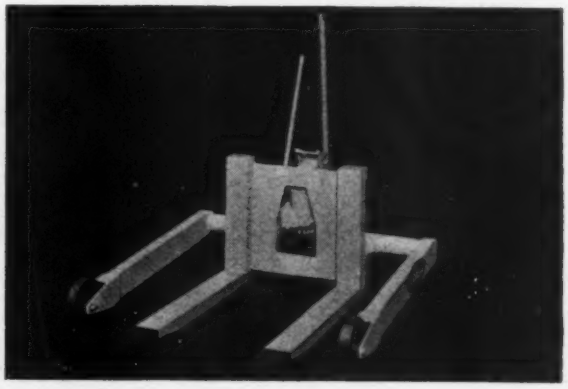
5 cwt, but the winch, used separately, can deal with 6 cwt loads on a two-fall rope rig. There are four models, three powered respectively with 1·2-h.p., 1·9-h.p. and 2·25-h.p. Villiers 4-stroke air-cooled petrol engines and one with a 1·5-h.p. weatherproof electric motor and starter for 400/415-V or 110-V 3-phase A.C. supply. The winch is fitted with 3-speed gear for light, medium and maximum loads. To ensure smooth slewing movement, the kingpost is fitted with bearings top and bottom and a safety feature is an overwind limit guarding against upsetting loads and damage to the sheave assembly. For use on scaffolding, the scaffold tube is fitted throughout with extensions by which it can be tied back to provide maximum security. Where this is impracticable the use of the base stand is specially suited for flat roof repair work.

The makers, A.C.E. Machinery, Ltd., Porden Road, Brixton, London, S.W.2, have also introduced a crane bucket for use with the midget hoist and other lifting equipment. Of 3 cu. ft. capacity

*The Forager 2,000-lb capacity battery electric platform truck*




*The 1-ton Forager hand pallet transporter*



and of conical shape for clean and easy discharge this is constructed of ⅛-in thick mild steel with seam and top and bottom strengthening bands and fitted with a steel lifting bridle with locking clip.

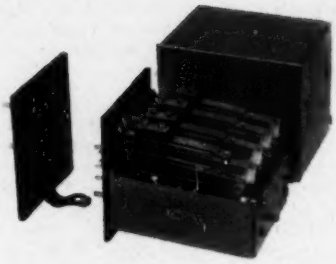
### AUTOMATIC PRESS FEED EQUIPMENT

The new 12-in capacity automatic press feed, which can be attached to almost any make or size of press, is fundamentally the same as the 6-in feeder produced by George F. Clark & Sons (Toolmakers), Ltd., Swan Works, Colham Mill Road, West Drayton, Middlesex, but of very much heavier construction. It is operated from the crankshaft of the press through a universal-jointed telescopic shaft driven by a bevel gearbox. All forces exerted upon it are contained in one casting and there is thus no tendency for parts to become loose or wear due to uneven loads working between separate items. Movement of the material is harmonic at whatever setting is used, and the feed period takes place over 210 deg of press cycle so that utmost control is maintained while the material is moved at the slowest possible rate. It is therefore possible to maintain a high degree of accuracy even when maximum capacity is being used.

Mounting of the mechanism requires only the drilling and tapping of two holes in the side of the bed of the press and two holes in the side of the brake drum. Thus only 1 in of the bed is used, leaving the area capacity of the press virtually the same as before the feeder was fixed. As the feeds can be adjusted angularly on the mount, no special care is needed for setting the tool square in the press. Provision is made for timing the feed cycle in relation to the press cycle, so that varying types of tool can be accommodated.

### PLUG-IN ELECTRICAL RELAY

Londex, Ltd., Anerley Works, 207 Anerley Road, London, S.E.20, announce that a new version of their Londex Type LF relay is now available in plug-in form. In this form it provides a unit which can be changed with the minimum of disturbance and makes maintenance easy, particularly on assembly line control circuits. An 18-way plug and socket is used which allows for a wide variety of contacts to be accommodated. The maximum is eight normally open or eight normally closed or any combination. Alternatively, five change-over contacts can be fitted. The rating of these is 4 amp at 250 V A.C., the operating voltage for the coil can be from 2 to 600 V A.C. or up to 180 V D.C. and the power required is from 4 to 12 VA, depending on the number of circuits. A retaining clip fitted to the socket holds the relay firmly in position. Overall dimensions are $2\frac{3}{4} \times 3\frac{1}{2} \times 4\frac{3}{4}$ in.



*The Londex Type LF plug-in electrical relay*

### COMBINED BOLSTER AND JIB CRANE

Designed initially for a large firm of builders' merchants, the Bradshaw patent combined bolster and jib crane enables the driver of an open vehicle to unload a variety of goods up to half a ton in weight single-handed. It is also combined with a tubular steel bolster normally secured at the front end of the vehicle to support long lengths of material. It can be used for tying back and supporting goods and be fixed in any desired position. The equipment may also be installed in the Land-Rover type of vehicle.

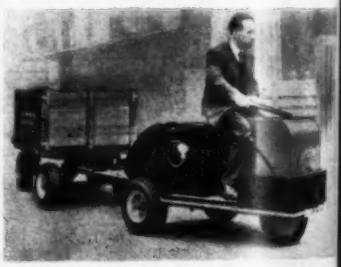
For loading and unloading, a removable swinging arm which fits into the left-hand or right-hand upright of the bolster is used for lifting and lowering goods with any standard make of chain or rope block. The fitment can be obtained in a suitable size for fitting to any open goods-carrying vehicle and the makers, the Lichfield Engineering Co., Ltd., Stowe Hill, Lichfield, Staffs., have compiled a table to show the safe working loads in relation to the vehicle tracks. Costing under £30, this equipment is an attractive proposition to single vehicle or fleet owners since it increases the earning capacity of a vehicle by ensuring a quick turn-round.

### INDUSTRIAL ELECTRIC TUG

For use with suitable four-wheel trailers the new Wrigley E733 driver-controlled 3-wheel electric tug has a hauling capacity of 4 tons. Current for its S.E.M. 2·3-h.p. series-wound motor is supplied from a 30-V 166-Ahr Exide Ironclad battery in a steel plate case. Three alternative batteries of 179, 192 and 206 Ahr capacity are available. The charger socket incorporates a safety device preventing the truck from being driven away whilst connected to the charger. A Westinghouse VZ15/20 charger with time control relay automatically terminates the charge when completed.

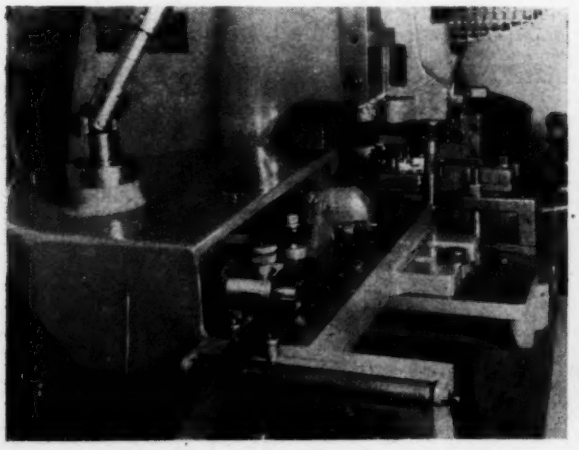
The drive to the front wheel is by a duplex primary chain, reduction gear with adjustable jockey chain tensioning sprocket

(*Continued on page* 239)

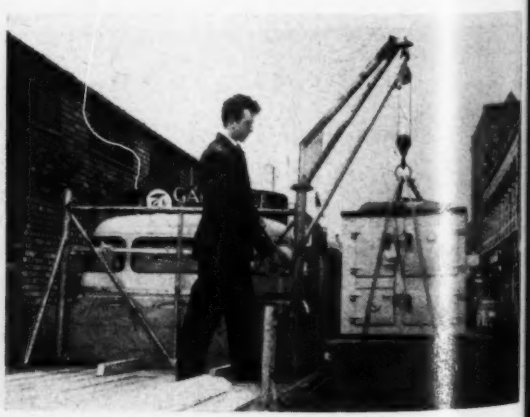


*A 4-ton trailer load can be hauled by the new Wrigley industrial electric tug*

*Application of a Clark automatic feeder to a press*

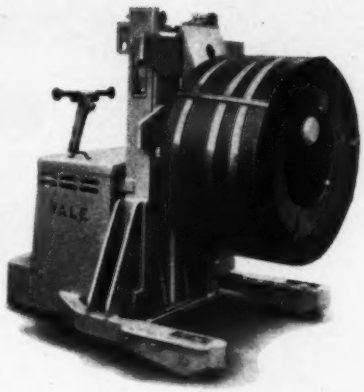


*An open lorry equipped with the new Bradshaw combined bolster and jib crane*

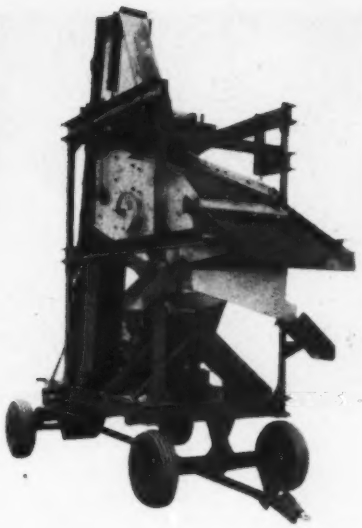


and a triplex secondary chain running in an oil bath housing carrying the motor and drive wheel assembly. The power unit assembly is mounted on two taper roller bearings to take thrust loads, one above and one below the motor, in two horizontal arms, allowing full 90 deg turn in either direction. Steering is direct by handlebar or by geared steering wheel. An accelerator pedal operates a 5-speed controller, which with a contactor and resistance provides smooth starting, inching and speed control. A reversing switch in front of the driver has a detachable hand lever removable after switching off to prevent unauthorised use of the truck. Pedal-operated 8-in brakes on the rear wheels are also applied by hand lever for parking. The tyres are 18 × 7-8 pneumatics, but 18 × 4 or 15 × 5 solid or cushion rubber-tyred wheels can be fitted.

Manufacturers are Wessex Industries (Poole), Ltd., Dolphin Works, West Street, Poole, Dorset.



*The new Yale Worksaver electric truck handling a coil of strip metal*

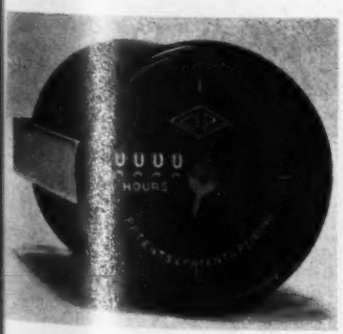


*The Moxey portable screening plant with the Moxey-Dillon vibrating screen*

## ELAPSED TIME INDICATORS

Primarily for use with any moving machinery or electronic equipment, the new elapsed time indicator developed by Cass & Phillip, Ltd., Caslip Works, Mark Road, Adeyfield, Hemel Hempstead, Herts., by registering the true operating hours of a machine or vehicle, is invaluable when assessing maintenance requirements. In addition, its indication of the load or utilization factor of machine tools, fork lift trucks and production equipment of all kinds is essential for working out the most effective methods of daily operation.

*Cass & Phillip elapsed time indicators for recording running hours of (top) moving machinery or electronic equipment and (bottom) agricultural and industrial tractors*



The new completely sealed and insulated unit has a double-skin case, the mechanism being mounted on beryllium copper-leaf springs. The balance staff and wheel and armature assembly are jewel-mounted, resulting in very rugged construction. The four leaf springs, spaced at 90 deg, carry the complete mechanism and are located in grooves moulded in a polythene case. This assembly is installed in a steel outer case, and electrical contact is made through insulated terminals in the rear. The dial glass is located in a recess of the polythene case and a rubber ring held by the bezel completes the sealing against ingress of water and dust. The instrument movement is electrically insulated from the case which thus provides no connection to earth like earlier models. Elapsed time is read in hours and minutes to the nearest 15 sec, and timing accuracy is better than 15 sec in 24 hours.

In previous instruments the drive between the centre shaft and hour counters was by means of a 1 : 1 reduction gear, causing unnecessary friction and loss of energy. Now it is taken from the centre shaft to the hour counters located just above the left centre of the dial instead of at the base. With these modifications the indicator can be used under very adverse conditions of humidity and vibration and is suitable for use in electrical circuits where earthing of the case is a disadvantage.

Of basically similar construction, a second new indicator is available for recording tractor running hours. The principal difference is that the inertia in the balance assembly gives an overrun of about 7 sec when the current is interrupted. This does not affect the time indicated as there is insufficient torque to drive the hour counters when current is switched off. A direct hour reading is taken off the hour counters and a rotating device shows when the meter is functioning. Electrical connections can be made to the ignition system, or to a diesel engine 12-volt starter battery, using a pressure switch in the lubricating oil system as the starting and stopping control.

## ELECTRIC TRUCK FOR CONFINED SPACES

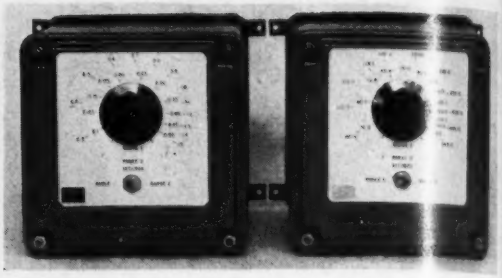
Particularly suitable for service where space is limited, a new Yale Worksaver electric truck can handle press tools or coils of strip metal up to 5 ft in diameter and 20 in wide. A variety of specially designed attachments can be supplied. For coil handling, a ram or pair of forks, shaped to minimise damage to coils, may be used and a semi-circular ram permits coils to be directly removed from coil-winding machines. A solid platform or a pair of forks permits press tools to be handled where space limitations prevent the use of a die-handling or large fork truck.

Mounted on castors, the truck is pedestrian-controlled and fitted with heavy-duty straddle legs. The lifting attachments are raised by a vertical hydraulic ram and twin chains with controls on the hinged drawbar. Equipped with fixed upright mast channels similar to those of the Yale Series 51 fork trucks, coils can be lifted to a height of 64 in by a truck having an overall height of 90 in.

The truck is produced by the Yale & Towne Manufacturing Co., Wednesfield, Wolverhampton.

## PORTABLE SCREENING PLANT

The use of the newly developed Moxey portable vibrating screening plant for handling sand, gravel, shale, coal, ash and other materials avoids the considerable expenditure of time, labour and costs incurred where they have to be transported to existing stationary plant from workings not easily accessible or situated a long distance away. Robustly constructed, suitably braced for rough usage and mounted on four pneumatic-tyred wheels, the plant is powered by an air-cooled diesel engine and capable of continuous operation over long periods.



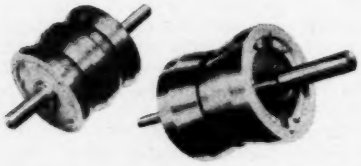
ABOVE

*Two of the new series of electronic process timers produced by Lancashire Dynamo Electronic Products, Ltd.*

It is equipped with a Moxey-Dillon full-floating, circle throw vibrating screen designed and suspended to transmit no vibration to the supporting structure or chassis. The carbon steel eccentric shaft is carried in two heavy-duty spherical roller bearings protected by labyrinth grease seals, excluding dust and grit and lubricated through high-pressure grease nipples at the ends. Provision is also made for periodic flushing of the bearings.

Material delivered by hand, excavator or grab into the feed hopper is lifted by bucket elevator and fed on to the full width of the screen. Oversize material is rejected by chute and graded material is loaded by other chutes into vehicles.

Manufacturers are Moxey, Ltd., 13 Augustus Road, Birmingham, 15.



*Concave magnetic rolls for conveying pipes from the galvanizing bath, produced by Rapid Magnetic Machines, Ltd.*

## CONCAVE MAGNETIC CONVEYOR ROLLS

A new range of concave rolls to augment their standard range of magnetic roll equipment has been introduced by Rapid Magnetic Machines, Ltd., Lombard Street, Birmingham, 12. For the conveyance of freshly galvanized pipes from the bath to a rack or mechanical conveyor, the operator simply hooks each pipe from the bath by means of tongs and places one end against the underside of the magnetic roll by which it is transferred in a suspended position. The usual arrangement includes a series train of three to eight magnetic rolls, the pipes being conveyed at about 12 deg inclination to allow for adequate drainage. The rolls are manufactured in two diameters, 15 in for pipes up to 3 in dia and 18 in for up to 6 in dia pipes. Double rolls are also available.

ABOVE LEFT

*The latest VLL/10 drum-lifting device introduced by British Electrical Repairs, Ltd. The clamps are closed on the drum as shown before lifting*

## IMPROVED DRUM LIFTING DEVICE

A modified version of their VLL/10 drum-lifting device, incorporating pre-loading safety mechanism, is announced by British Electrical Repairs, Ltd., Manchester. It can be supplied to handle drums of any type, size and weight. Pre-loading—the application of adequate clamping pressure before the drum leaves the floor—eliminates danger of load-slip and makes the device suitable for snatch lifting.

Whilst suspended from a crane or hoist hook prior to lifting, the clamps remain in the locked open position, but when the device has been lowered on to the drum end, movement of a hand lever through 190 degrees sets the clamps in the pre-loading position. As the drum is lifted, clamping pressure is further increased by the supporting lever linkage mechanism. Steel-backed bronze bearings are incorporated, arranged for grease gun lubrication. A power-operated model is equipped with fully automatic or remote electrical control which, for example, may be operated by the driver of a mobile crane. When fitted with large arc clamps, the device is equally suitable for handling open-top steel drums and cardboard drums now widely used for packaging.

In addition to drum-lifting devices for vertical and horizontal lifting, the makers have developed a range of manual- and power-operated devices for lifting and rotating drums through 360 degrees.

## FOR EASIER HANDLING OF POWER TOOLS

By suspending a heavy hand tool, such as a portable power drill or spot welding gun, from an Aro spring balancer an operator can reduce the effort required to hold it in the working position, facilitate its application and reduce the possibility of damage, breakages, hold-ups and accidents. Manufactured by A.R.O. Machinery Co., Ltd., 190 Castelnau, London, S.W.13, five balancers of two basic types are available, ranging in load capacity from 26 lb to 40 lb to 85 lb to 132 lb.

With a balancer in use a tool remains balanced over a distance of 5 ft to 5 ft. Finger tip pressure raises it out of the way and returns it to working level. By means of a stop-start control the load can be locked into position and released when required, the control being always within easy reach of the operator. An automatic built-in safety device protects the tool and operator against spring rupture or accidental break-away of the load.

## ELECTRONIC PROCESS TIMERS

The wide range of electronic process timers produced by Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs., has been increased by the recent addition of the low-priced Series PCT.1. The new

(*Continued on page 241*)

*A spot welding gun in use in a metal furniture factory, suspended from an Aro spring balancer*

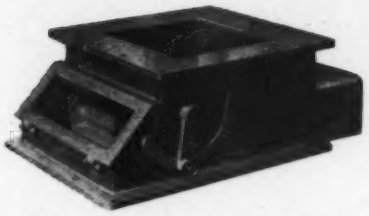
units are available in six basic forms, depending upon the required time range and can be connected together to provide multi-stage time control for complete processes. They are designed to provide time ranges of (*a*) 0·1 to 1·5 sec, (*b*) 0·3 to 5 sec, (*c*) 1 to 15 sec, (*d*) 3 to 50 sec, (*e*) 10 to 150 sec and (*f*) 30 to 500 sec. Each main time range is sub-divided into 'Long' and 'Short' ranges, selected by a switch and a continuously variable control provides for accurate setting of the required time interval. The units have a repeat accuracy of — 1 per cent on a stable supply and variations in supply voltage of ± 15 per cent to 10 per cent will not cause more than ± 5 per cent change in the set time interval.

The timers are housed in cast alloy cases designed for wall or base mounting. Detachable covers are sealed to prevent ingress of dust and moisture. The timing controls are mounted on the front of the case, the time setting control being provided with a scale calibrated directly in seconds. The timers are designed for 200/250 V or 110/115 V 50/60 c.p.s. single-phase supplies.

## VIBRATORY FEEDER FOR DRY MATERIALS

For feeding dry materials to grinding, pulverizing or mixing plants, W. S. Barron & Son, Ltd., Bristol Road, Gloucester, have produced the new Lea-Bar Vibra feeder operated by 240-V single-phase A.C. current. Vibration is effected by electro magnet with variable amplitude control, intensity of stroke being varied to suit the product, long strokes for light and short for dense granular materials. Controllers for connecting direct to a 50-cycle supply incorporate a rheostat, giving almost infinite control up to maximum capacity of the machine concerned. Arranged for separate mounting, they can be used with the normal sinusoidal wave form, or this can be split by a half-wave rectifier in the controller, giving sharp interrupted action to the magnet. A longer and more effective stroke is thus obtained than with unrectified current and is responsible for the positive action of the feeder.

The tray is pulled sharply back at each pulsation and returned to its original position at slightly lower rate by leaf and coil springs during the dead period of the magnet. The material falls vertically as the tray is pulled back under it and takes up an advanced position relative to the tray by which it is moved forward by the reciprocating action of the springs. This cycle repeated at high speed causes the material to flow forward with infinite variation, from maximum capacity to a trickle, by adjustment of the rheostat. Automatic control over the feed rate is maintained by the Philip Lea Mk. II load control panel, which ensures maximum constant load on the motor of the plant to which the feeder is applied.



*The Barron Lea-Bar Vibra feeder for dry materials*

# TRADE NOTES

### Lancer Side-loader

At the Millwall depot of Montague L. Meyer, Ltd., the timber importers and dealers, the British-built Lancer side-loading fork lift carrier recently made its first appearance before members of the technical press. In a demonstration of timber handling the new machine exhibited a capacity for high speed and manœuvrability and created a very favourable first impression.

In reply to questions, F. Garrod, a director of Montague Meyer, said that after having acquired one Lancer side-loader this company had placed repeat orders for two further machines, one of which was in service at another depot. He estimated that the two trucks operating at Millwall were handling an average throughput of 1,800 tons a week on the wharf and in the mill and storage areas, and most of the material was moved five times.

Operational cycles of picking up, transporting, and setting down, were timed by the visitors. It was found that the average lift, under load, with the forks raised from ground level to the 12-ft maximum height, was 6·75 sec—corresponding to a lifting speed of 107 ft/sec—and the average traverse occupied 4·5 sec.

Loads of the kinds likely to be encountered in the timber industry were handled during the demonstration, including planks up to 38 ft long and 4-ton logs. This 33 per cent overload was doubled when 5-ton bundles were picked up and set down.

Montague Meyer estimate that the introduction of the side-loaders has enabled them to raise the output of their mill by 25 per cent and will ultimately result in a 50 per cent increase in productivity. Their directors have afforded *Mechanical Handling* facilities for examining the way in which the trucks are being used, and an account of the investigation will be published in a future issue.

*Lancer 3-ton side-loader, a new machine built in Britain from British components, at the Millwall depot of Montague L. Meyer, Ltd. With power-assisted steering and excellent visibility, it is a fast and manœuvrable tool for handling long and cumbersome loads*

### Mechanical Handling Engineers' Association Education Prize Scheme

In order to encourage the progress of technical education within the industry, the Mechanical Handling Engineers' Association has again decided to award prizes in 1959, to employees of its members who attain certain qualifications during the period from November 1st, 1958, to October 31st, 1959. The prizes will take the form of technical or scientific books, or at the discretion of the employer, in collaboration with the Education Sub-Committee of the Association, in the form of instruments, tools, entrance fees to professional institutions defined in the scheme, or in any other suitable form, except by cash payment.

Full details of the prizes—which may be up to £20 each in value—and qualifications required, may be had from the M.H.E.A., 94-98 Petty France, London, S.W.1.

### Robert Dempster & Sons, Ltd.

Robert Dempster & Sons, Ltd., of Elland, held their annual Apprentices Prize Distribution recently. The event was attended by a large gathering of apprentices, parents and friends. Among the many successful apprentices were D. Sykes, M. Taylor and M. Mellor each of whom received awards under the Mechanical Handling Engineers' Association Education Prize Scheme.

### Swiss Industrial Fair

An interesting range of materials handling equipment will be on show at the Swiss Industrial Fair to be held in Basle from April 11th to 21st. The display is intended to provide a comprehensive idea of the standards attained in Switzerland in the field of modern goods handling and transport. Conveyors, trucks, containers and pallets, and stacking cranes will be among the equipment featured. There will also be a model of a handling yard, for canal vessels, railway wagons, and motor vehicles, with travelling cranes and stacking trucks co-operating in teams.

### Scottish Industries Exhibition

The Third Scottish Industries Exhibition will be held at the Kelvin Hall, Glasgow, from September 3rd to 19th, 1959.

The first two exhibitions of 1949 and

*A 1,350-ft conveyor belt, the biggest single length of belting ever built by the Goodyear Tyre & Rubber Co. (Gt. Britain), Ltd.*

1954, attracted over one million visitors, among them thousands of trade buyers, and business to the value of £20 million directly resulted. It is stated that more mechanical earth-moving equipment is made in Scotland than anywhere else in the free world, except the U.S.A., and this type of equipment will be prominently featured, as well as a wide range of other engineering products.

**Industrial Machine & Equipment Co. (Brimpex), Ltd.**

The above company, makers of the popular 'Brimpex' hydraulic lifting machines, have moved to additional new and modern premises at Yorktown Industrial Estate, Camberley, Surrey. (Telephone: Camberley 2688.) This step has been taken to enable the company to meet the constantly expanding demand for their products. It is reported that one company alone has 88 'Brimpex' lifters in use at the time of going to press.

**'Moving with the Times'**

A new industrial film, *Moving with the Times*, has been produced by Sovex, Ltd., Erith, Kent. The film depicts a number of Sovex mechanical handling installations at locations such as London Airport, the Rolls-Royce factory at Derby, Grattan Warehouses, Bradford, Guest, Keen & Nettlefolds, Birmingham, a warehouse of Boots, the Chemists, at Nottingham, and the Wishaw factory of Smiths English Clocks, Ltd.

The film is 16-mm, sound, in black and white. The running time is approximately 25 minutes.

**New Agency for Devonport Machinery**

Devonport Machinery Co., Ltd., materials handling specialists of 96 Warwick Street, Leamington Spa, Warwickshire, have been appointed concessionnaires for Walter Somers (Materials Handling), Ltd., Hales Owen. Walter Somers, the lifting equipment specialists, are manufacturers of automatic lifting tongs.

**An Outsize Conveyor Belt by Goodyear**

One of the biggest single lengths of conveyor belting ever built by the Goodyear Tyre & Rubber Co. (Gt. Britain), Ltd., was recently completed at the company's Wolverhampton plant.

Constructed in 32-oz. cotton duck, this 42 in × 8-ply Goodyear Stacker belt, with a top cover of $\frac{1}{4}$ in and a bottom cover of $\frac{3}{32}$ in, runs to a length of 1,350 ft. Weighing approximately 11 tons, it has a maximum plant diameter of 11 ft. A Leno breaker was included in the construction of the top cover to prevent gouging, covers stripping and loading impact cuts.

The belt was ordered by Guest, Keen & Nettlefold, Ltd., of Eastmore Works, Cardiff, for carrying iron ore. The photograph shows the belt ready to be lifted from the A-frame prior to trimming and final inspection.

**County Council Use International Drott Shovels With Versatile '4-in-1' Buckets**

Two International BTD-6 tractors with Drott '4-in-1' shovels owned by the Northumberland County Council are proving very efficient in use at road improvement work.

On one particular job it was required to remove the existing tarmacadam surface and excavate to a depth of about 2 ft 6 in. As it was necessary to keep the road open to traffic, only half the width could be tackled at one time, and the Drott proved to be particularly suited to this work on account of its low overall width (5 ft 8 in). The road surface was easily scarified without the aid of a compressor, by means of the Drott rear-mounted three-tine hydraulic ripper. The spoil was then excavated and loaded over the tailboards of wagons, which were placed at the forward end of the cut. Normally, when this operation is performed, a pile of material is pushed up by the shovel at the end of the cut, and this hinders the movement of the tractor and renders it unstable at the loading point. The '4-in-1' shovel proved to be of particular advantage in this respect, however, as on the reversing part of the cycle, the operator opened the clamshell with the touch of a lever, and dragged this surplus material back into the cut.

The extra loading height gained by the bottom discharging facility of this bucket has proved to be of great advantage when it is required to load wagons with the machine still in the cut.

Two other important features of the '4-in-1'—the bulldozer and the clamshell—have also found useful application on other work within the county. In one instance, after lifting stone setts on a narrow trunk road passing through a busy country town, the Drott was required to work in a very cramped space to load the spoil without pushing any on to newly laid concrete. This was easily accomplished with the clamshell, without interference with the other work.

**Herbert Morris, Ltd., and British MonoRail, Ltd.**

The British and American shares of British MonoRail, Ltd. (Wakefield Road, Brighouse, Yorks.), have been acquired by Herbert Morris, Ltd., of Loughborough.

British MonoRail, Ltd., specialize in the design and manufacture of ultra-modern overhead handling equipment, including what are claimed to be the most highly developed underslung cranes available in Great Britain. Under the new arrangement the company will now be able to finance the final stage of the introduction of a complete new range with a load-carrying capacity up to 10 tons.

By the acquisition of this progressive company, Herbert Morris, Ltd., maintain their part in meeting the ever-increasing demand of British industry for the latest materials handling equipment, a field in which they have operated for the past 50 years.

Mr. Frank Morris, chairman of the Herbert Morris, Ltd., group of companies, has been appointed chairman of British MonoRail, Ltd., and Messrs. E. Russell and G. Randsley of the board of Herbert Morris, Ltd., have also been appointed directors of British MonoRail, Ltd.

Mr. James Dallas the managing director of British MonoRail, Ltd., will continue in that appointment.

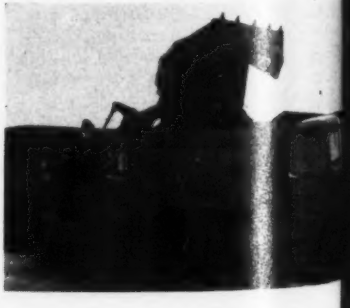
**David Brown Construction Equipment, Ltd.**

In order to ensure closer contact throughout Great Britain with the actual users of its full range of industrial wheeled and crawler tractors and equipment, David Brown Construction Equipment, Ltd., Hanworth Park, Feltham, Middlesex, has recently set up Sales Departments at its Northern and Southern Depots. Previously, the Sales Department was centralized at Hanworth.

In future the Northern Depot (manager, Mr. S. Hallam) located at Moll Springs Mills, Honley, Huddersfield, will cover North Wales, the North of England, Scotland and Northern Ireland. The Area Sales Engineers based at the Northern Depot will be Mr. A. Milnes (senior Area Sales Engineer) North Wales, North West England and Northern Ireland; Mr. C. Boothroyd, North East England; and Mr. D. Nicholson, Scotland.

(*Continued on page 243*)

*An 'International' BTD-6 tractor with Drott '4-in-1' shovel at work on road improvement in Northumberland*



The Southern Depot (manager, Mr. L. Pattison), located at Hanworth Park, Feltham, Middlesex, adjacent to the headquarters will cover the South of England and South Wales. The Area Sales Engineers based at this Depot will be Mr. D. Mole, London and the South East of England; Mr. F. C. Cambridge, South West England; and Mr. H. Rigby Smith, East Midlands and Eastern counties.

**Yale & Towne Opens New Service Depot in Scotland**

The Yale & Towne Manufacturing Co. has recently opened a new service depot in Scotland. Situated on the modern Nerston Industrial Estate at East Kilbride, the new depot is adjacent to the main road from Ayr to Stirling and is only nine miles from Glasgow. It gives immediate spare parts service to all Yale users in Scottish industrial areas. Yale service engineers also operate from Stirling and Newcastle.

The depot, besides stocking the majority of service parts for the Yale range of trucks, has up-to-date facilities for overhauls and repairs.

The full address of the depot is: The Yale & Towne Service Depot, Wilson Place, Nerston Industrial Estate, East Kilbride, Lanarkshire. The telephone number is—East Kilbride 20241.

**New Walking Dragline for United Steel's Ore Mining Branch**

Erection of a £396,000 Ransomes & Rapier walking dragline is at present in progress at the Yarborough ironstone quarry, Scunthorpe, of the Ore Mining Branch of The United Steel Companies, Ltd. The 790-ton machine, known as a W600, is expected to begin work in June. It has a 186-ft long jib and its 10-cu. yd. bucket will enable it to strip 15 tons of overburden at each 'bite'.

The W600 is the second machine of its kind in the Scunthorpe area, the previous one having been in operation at the Ore Mining Branch's Crosby Warren quarry for the past two years. Both quarries supply the adjacent works of Appleby-Frodingham Steel Co., with iron ore.

**BTR Industries, Ltd., wins Russian Order for Rubber/'Terylene' Conveyor Belting**

Nearly six miles of rubber-covered conveyor belting designed and manufactured by BTR Industries, Ltd.—some of it almost certainly the widest and thickest ever made—is now on its way to a large ore field in the Soviet Union. The contract was obtained against world competition and was completed on schedule within three months.

This vast Soviet conveyor installation is believed to be unique in demanding belting of exceptional width designed to standards never before attained—and in that it is the first application of 100 per cent 'Terylene' fabric in a major conveyor system. The special heavy fabric was woven to BTR design from 376,000 lb of 'Terylene' yarn.

The belting has been supplied in three widths: 1,400 mm (55⅛ in), 1,600-mm (63 in) and 2,000-mm (78¾ in) and shipped in 50 rolls each about 180 metres (590 ft) long. It is made up of 8 to 14 plies of 'Terylene' fabric with skim coats between plies—the widest belting with a 6-mm thick top cover including a nylon transcord breaker and a 2-mm thick back cover. 'Terylene' was chosen for the job because it is the fibre having the best combination of outstanding strength whether wet or dry, flexibility and resistance to impact, stretching, abrasion and rot. The maximum working tension in the wide belting is 60,000 kg (59 tons) and is capable of transmitting in excess of 1,000 h.p.

The 14-ply × 78¾ in belting is some of the widest and toughest ever made but, together with the narrower constructions, it troughs readily under its own weight. The belts are being vulcanized endless on site in the U.S.S.R. with equipment designed and supplied as part of the contract.

**Wheels Smooth the Way for Stereophonic Equipment**

Nearly 6,000 smoothly flowing wheels have helped solve production problems raised in the construction of stereophonic reproduction equipment.

E.M.I. Sales & Service, Ltd., of Hayes, Middlesex, found it necessary to expand their production line to meet the heavy demand for Capitol Stereo Reproducers. The line was of a highly specialized type, and the accuracy of each operation depended largely upon the operative's access to the conveyor line.

The Dexion design and construction department were called in and they produced plans for three runs of complex conveyor systems, each 130 ft long, and each tailored to exact working levels, using the Dexion Glidewheel gravity conveyor system.

The system and the associated racking was built in 50 man days. The construction team were actually at work less than two weeks.

**Parker Plant at Work on new Hong Kong Airport**

Completion of a new runway at Hong Kong Airport—formerly Kai Tak Airport—some months ago means that aircraft such as the *Comet* 4, the *Boeing* 707 and the D.C.8 can now operate scheduled services through Hong Kong.

The entire length of the main taxiway and all associated taxiways and 7,340 ft of the main runway were of flexible construction, the top layers comprising a crushed stone base 12 to 14 in thick surfaced by 4½ in of asphalt in two courses.

Plants made by Frederick Parker, Ltd., of Leicester, England—three crushing units and a 'Starmix' 39 asphalt plant, all electrically operated—were used on this work.

# PUBLICATIONS RECEIVED

**Vickers-Armstrongs (Tractors), Ltd.**
A new brochure dealing with Vickers Onions scrapers and other earthmoving equipment has been issued by the above company, of Vickers House, Broadway, London, S.W.1.

**Westinghouse Brake & Signal Co., Ltd.**
Four new and revised brochures dealing with Mining Equipment have been issued by Westinghouse Brake & Signal Co., Ltd., 82 York Way, King's Cross, London, N.1.

**Lancashire Dynamo Group**
An illustrated article on variable speed drives is among the contents of Issue No. 16 of 'Electricity in Industry', published by the Lancashire Dynamo Group, St. Stephen's House, Victoria Embankment, London, S.W.1.

**John Summers & Sons, Ltd.**
A new booklet has been produced by John Summers & Sons, Ltd., the sheet steel manufacturers of Shotton, Chester, to illustrate the development and expansion at Hawarden Bridge Steelworks since January 1st, 1948.

**BTR Industries, Ltd.**
The above company, of Herga House, Vincent Square, London, S.W.1, have published a new illustrated hose catalogue intended for users of all kinds of hose, from the slender tubings of delicate instruments to suction hose of over 18 in inside diameter.

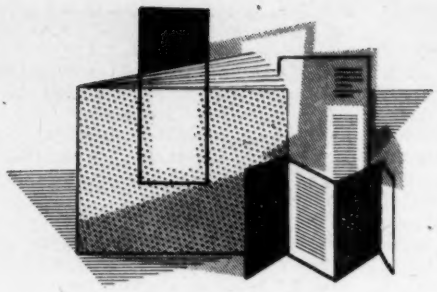
**Yates Plant, Ltd.**
Leaflets dealing with their mechanised welding shop plant, welding manipulators, universal clamping fixtures, etc., have been issued by the above company, of Whidborne Street, London, W.C.1.

**Priestman Brothers, Ltd.**
Activities of Priestman Brothers, Ltd., of Hull, are reviewed in Volume 2, Number 13, of *Priestman News*, recently published.

**Claude Lyons, Ltd.**
The above company, of Valley Works, 4-10 Ware Road, Hoddesdon, Herts, have issued leaflets dealing with (1) Variac Motor Speed Controls, (2) Stabilized C.D. Power Supplies; (3) Variable Power Supply; and (4) Automatic Voltage Regulator.

**Rupert & Co., Ltd.**
Precision Comparators and Electric Indicating Instruments are the subject of a new leaflet from Rupert & Co., Ltd., Acru Works, Demmings Road, Councillor Lane, Cheadle, Cheshire.

**Mavor & Coulson, Ltd.**
Idlers for belt conveyors are described in a new catalogue issued by Mavor & Coulson, Ltd., Farme Cross, Rutherglen, Glasgow. Full tables of sizes and weights are included as well as applications, sectional illustrations, etc. A new chart quickly gives the width and speed of belts for conveying any of seven weights of material at any required rate.



# ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

## CARGO HANDLING

**Mechanizing the Daily Work in the Ports.** By R. B. Oram. *Manchester Guardian*, 3 Cross Street, Manchester, 2. February 11th, 1959. P. 12. 3d.

Some of the difficulties to be contended with when installing handling equipment in ports are discussed by the author, who compares the complexity of the work involved in cargo handling with the comparative simplicity of the handling of materials in a factory.

After outlining the functions of quay cranes and mobile cranes, he concludes that the combination of the mobile crane and the fork lift truck affords the best example of efficient port mechanization.

**Speedier Cargo Handling on Board Ship.** By R. B. Oram. *Manchester Guardian*, 3 Cross Street, Manchester, 2. February 11th, 1959. P. 13. 3d.

Foremost among the progressive trends in cargo-carrying methods the author places the bulk handling of cargoes such as ore and sugar, the use of container traffic, and the exploitation of the unit load for the purposes of palletization and mechanization.

He traces the evolution of the unit load and the influence of handling techniques upon ship design.

## HANDLING SHEET STEEL

**Efficient Handling of Sheet.** By G. Rich. *Sheet Metal Industries*, John Adam House, 17-19 John Adam Street, Adelphi, London, W.C.2. January, 1959. Pp. 48-49, 52. 2s. 6d.

Hot and cold rolled sheet, flat and corrugated galvanized sheet, tinplate, black plate, and bar, are processed and stored in the works of the Rich Steel Co., Los Angeles, which was designed with the specific objective of facilitating the handling of these materials. In-line processing is adopted, and the lines are served by overhead travelling cranes. Material is transferred between bays by a reversible powered roller conveyor which can carry 10-ton loads.

Fork trucks and cranes are used in the loading and unloading bays, the cranes being equipped with scales for weighing loads of up to 20,000 lb.

## OPERATIONAL RESEARCH IN THE WAREHOUSE

**Maggazzinaggio e Ricerca Operativa.** By Vittorio Zignoli. *Trasporti Industriali*, Via Mantegna 6, Milan, Italy. November-December 1958. Pp. 940-944. 600l.

Some results of operational research into warehousing methods are contained in this report of the CRATEMA conference at Turin. Their effects on the technical aspects of warehousing and warehouse structure are outlined.

## PACKAGE DESIGN

**Imballaggio, Palettizzazione e Carichi Unitari.** By Nilo Galletti. *Trasporti Industriali*, Via Mantegna 6, Milan, Italy. November-December 1958. Pp. 945-952. 600l.

Package size and arrangement, and static and dynamic stresses, are analysed in relation to the palletized unit load. A summary is given of the work being undertaken by special committees formed by various international organizations.

## WAREHOUSE STOCKTAKING

**Organizzazione dell'Inventario dei Magazzini.** By Arturo Schiavetto. *Trasporti Industriali*, Via Mantegna 6, Milan, Italy. November-December 1958. Pp. 952-959. 600l.

A review of the stocktaking methods available to a mechanical engineering firm engaged on batch production. Activities are classified under five successive phases: preliminary work; planning and control; recording; stocktaking; and inventory planning.

## EARTHMOVING

**Evolution in Earthmovers.** By Karl Werline. *Dupont Magazine*, Wilmington 98, Delaware, U.S.A. October-November, 1958. Pp. 19-21.

Evolution of the earthmover is traced from the 3-m.p.h. graders of the 1930's to the 30-ton giants now at work on the highways that are being built across the Texas plains.

The author points out that without modern tractor-mounted equipment it would be impossible to produce the straight and level grading of these motorways, or to undertake the programme outlined in the Federal-Aid Highway Acts, under which 41,000 miles of new planned-access super-highways will be laid down and 775,000 miles of existing roads modernized within a period of 13 years.

## PORTABLE LIFTS

**Need a Lift?** *Distribution Age*, Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A. November, 1958. Pp. 38-39. 50c.

Several examples are given of the use of portable lifts to save space and overcome handling difficulties in old warehouse buildings. In some of these, the lifts are fitted with roller tops to enable a truck to be off-loaded by one man. Others are used outside, on the loading docks. In one example the lift is used to provide an adjustable work-table for packaging heavy machinery.

## AUTOMATIC MOULDING LINE

**Automatic Moulding Line Produces Sanitary Ware.** By Robert H. Herrmann. *Foundry*, Penton Buildings, Cleveland 13, Ohio, U.S.A. February, 1959. Pp. 72-75. $1.

Mechanized handling and moulding lines in a modernized foundry enable a 6,600-lb mould to be poured every 46 sec at the American-Standard foundry in Baltimore.

Sand is fed automatically by ploughs responding to signals from level-controllers in the hoppers. Flasks and moulds move around the moulding machines on rail-mounted conveyors, and their manipulation is effected pneumatically and co-ordinated by an indexing system in a fully automatic sequence of operations.

## HANDLING OIL-DRUMS

**Une Belle Installation de Conditionnement et de Manutention des Huiles.** *Manutention*, 40 Rue du Colisée, Paris 8, France. February, 1959. Pp. 57-64. 500 fr. (France), 600 fr. (countries outside France).

Mechanized handling of oil and oil-drums is described in this report of a visit to the ANTAR depot at Rouen. Equipment includes plant for the cleaning and painting of the oil-drums having a capacity of 60 to 90 containers an hour. There are three automatic lines for oil reconditioning.

Palletized preassembly is adopted for drums of oil awaiting dispatch. Roller conveyors are used to handle the drums during processing; in the storage area they are palletized. Current throughput is 25,000 tons, and this will be exceeded when present developments are complete.

## BOMB-LOADING LIFT TRUCK

**Constant Speed for a Telescoping Cylinder.** By Harry S. Mankey. *Applied Hydraulics and Pneumatics*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1958. Pp. 76-77. 75c.

Constant speed is maintained in a truck-mounted telescopic hoist by which 5,000-lb bombs are loaded into aircraft. Four pumps, arranged in parallel, are linked with relief valves to maintain constant pressure in the 11-stage telescopic cylinders, which range in diameter from 10 in at the bottom to 5 in at the top when fully extended to give a 15ft lift.

The hydraulic circuit and other details are illustrated.

## FORK LIFT CRAWLER TRACTOR

**Four Fluid Motors Give Lift Truck Series Parallel Drive.** By Charles S. Davis and John Sharp. *Applied Hydraulics and Pneumatics*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1958. Pp. 88-90. 75c.

In the crawler-mounted fork lift truck described in this article, the mast assembly and the driver's platform are carried amidships and extended forward for picking up and setting down loads. These and other motions are hydraulic.

Tracks are driven by two separate hydraulic motors, coupled to operate either in series or in parallel.

(*continued on page 245*)

HANDLING MERCURY
**Some Aspects of Handling Mercury.** By J. G. S. Biram. *Vacuum*, Edwards High Vacuum, Ltd., Crawley, Sussex. October, 1959. Pp. 77-92. 15s.

The author deals from practical experience with some of the difficulties involved in the handling of large quantities of mercury. In its resistance to normal means of detection and in the health hazards involved, this substance is reminiscent of radioactive materials.

Insolubility, the combination of high weight and low viscosity, volatility, and the tendency to form droplets, are its most dangerous characteristics. These create trouble when attempts are made to pump or pour it and result in the permanent contamination of surrounding materials. In the author's opinion, the first safeguard to be adopted when dealing with mercury is to provide means of containing it, and suitable media are discussed. Mention is made also of the sludge formation that occurs after pumping or stirring, and its effect upon mechanical equipment. An extensive list of references to other aspects of the handling problem is included.

LIVE STORAGE WITH AUTOMATIC SELECTION
**Philco's Pace-Setting New Warehouse.** *Modern Materials Handling*, 221 Columbus Avenue, Boston 16, Mass., U.S.A. February, 1959. Pp. 97-101. $1.25 (U.S.A. and Canada), $2.30 (other countries).

Magnetic-disc data storage is employed in a system installed in the new Philco warehouse for the automatic handling and selection of television sets. Cartons containing the 140 Philco models come off the production line at a maximum rate of 1,200/hr and are diverted to their appropriate lines of storage conveyors. Outgoing cases are withdrawn from the storage conveyors and grouped by a palletless loading machine into four alternative patterns of unit load.

Up to this point the entire process operates under push-button control. Unit loads of cartons are handled by fork trucks equipped with load clamps and individual cartons by trucks employing a vacuum grip.

TRAINING FORK TRUCK DRIVERS
**How to Sell a Driver Training Programme.** By William E. Dobbs. *Materials Handling Engineering*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. February, 1959. Pp. 62-63, 103. 75c.

The training officer of the Consolidated Mining & Smelting Company of Canada describes a scheme set up by his company for the training of their 100 fork lift truck drivers, who operate a fleet of 28 trucks on three-shift work.

Some of the men had been employed as drivers by the firm for many years, and a certain amount of resentment might therefore have been expected among them. This and other potential causes of trouble, including the fact that only one truck was available for training purposes, were circumvented by the exercise of intelligent anticipation and the scheme was well received. Benefits resulting from the five-day training course, plus a two-day course for supervisors, include a marked improvement in the standard of driving, better relations between management and employees and between drivers and maintenance staff, and a more positive and co-operative attitude to work.

# RECENT PATENTS

**The following are brief extracts of recent United Kingdom patents which we believe will interest our readers. For full details the original patent specifications should be consulted at, or bought (3s. 6d. each) from, The Patents Office, Southampton Buildings, Chancery Lane, London, W.C.2.**

CARGO HOLD
**R. & J. MacGregor, of Whitley Bay.—U.K. 754159.**

Reissued amended with a reference to patent 722546, and covering a design of channel posts and strong, nestable shutters and plates, which prevent cargo shift and grain seepage in cargo holds.

GRANULE FLOW MEASUREMENT
**British Iron & Steel Research Association, London.—U.K.804211.**

Dry powder, etc., flow rates are measured by the turning rate of a plate beneath the conveyor tip off, giving a linear scale for constant velocity.

DISHWASHER
**Hobart Manufactering Co., of Ohio.—U.K. 804239.**

For hotels and restaurants, a minimum size semi-automatic wash and rinse machine capable of cleaning a rack of plates every 35 sec.

BELT CENTRALIZING
**Fibreglass, Ltd., of Liverpool.—U.K.804250.**

Conveyor tendency to deviate laterally is corrected by rollers on the return journey, underneath, which slide in a carriage to give desired angular correction of inclination.

PLATE APRON
**Gebruder Eickhoff Maschinenfabrik m.b.H., of Bochum.—U.K.804276.**

Overlapping steel plate conveyor, held together by round-link chains of tougher design and reduced wear.

MOBILE CRANE
**H. Liebnerr, of Germany.—U.K.804378.**

Track-mounted crane capable of turning round rail curves without jamming, set on a platform mounted pivotally from corners on wheels and partly castored—also retracting for transport.

ROD CONVEYOR
**General Electric Co., of London.—U.K.804443.**

For cutting glass tubes to length, with gas burners and cold wet cutter, the tubes rotating as carried between endless rollers.

HOIST HOOKS
**W. H. & H. A. Cruse, of London.—U.K.804454.**

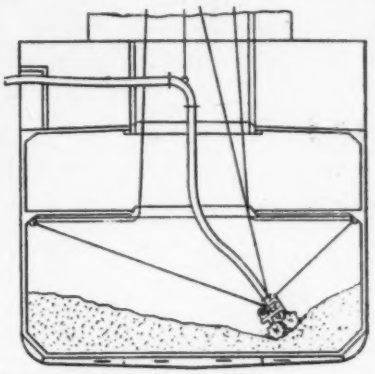
Ship's cargo hook, covered during swing, etc., by the clapper safety device, to prevent a free point getting entangled or damaging equipment.

OVERHEAD CONVEYOR
**Regie Nationale des Usines Renault, France.—U.K.804512.**

Bi-rail trolley conveyor for factories can be coupled in pairs, via bars in the hollow rails, to reduce height requirements.

CONCRETE PLACER
**Blaw Knox, Ltd., of Knightsbridge.—U.K.804513.**

Elongated curved container, with an inclined outlet pipe attachment. It can be pressurized and diameter decreases from top to bottom for easy concrete handling.



*Pneumatic Unloader—U.K.*804557

PNEUMATIC UNLOADER
**Unilever, Ltd., of Chester.—U.K.804557.**

Packing tendency of copra, coal, etc., overcome, with greater speed, by screw cutter conveyors on either side of suction pipe in hold.

GUIDE RAIL
**G. B. Berte, of Milan.—U.K.804743.**

Guide rail sections for hoists elevators, etc., are short, easily transported, light and simple to install.

PALLET HANDLING
**C. Cazenare, of Paris.—U.K.804760.**

Vehicle and pallet truck lifted by small gantry on lorry rear, by its four corners.

SURGE CONVEYOR
**Qualter Hall & Co., Ltd., Barnsley.—U.K.804856.**

Coal storage conveyor with a scraper a few feet above feed from a belt or plate conveyor.

LOG STACKER
**Société Auxiliare de l'Entreprise Auxen, of Paris.—U.K.804872.**

Small-section logs and pit props, etc., loaded with a luffing boom on a lorry, etc., using a pair of forks moving to form jaws, with prongs, or a shovel or grab.

TIN SHEET DELIVERY
**Aetna Standard Engineering Co., of Pittsburg.—U.K.804875.**

Cut tin plate at, say, 1,000 ft/min as per patent 690344 slowed down to moderate speed using a diverter alternately feeding two parallel conveyors.

ELEVATOR LORRY
**Commer Cars, Ltd., of Luton.—U.K.804890.**

For use in unloading aircraft; the whole platform floor elevates.

HAND TRUCK
**Willmot Trucks, Ltd., Worcester.—U.K.804918.**

Hand unit supported by legs at rest, easily raised for wheeling, can join to power unit of other trucks, and is steerable.

WHEELED TRAILER
**Sentinel Shrewsbury, Ltd.—U.K.805043.**

A low loader lorry trailer with rear

ASSOCIATED ILIFFE TECHNICAL BOOKS

*Books Recommended by*

**'MECHANICAL HANDLING'**

**ABACS OR NOMOGRAMS**

A. Giet, Translated and revised by J. W. Head, M.A.(Cantab.), and H. D. Phippen, M.A.(Edin.), B.Sc. (Lond.). 35s. By post 36s.

**CONSTRUCTIONAL STEELWORK SHOP PRACTICE**

John Farrell. 15s. By post 16s. 1d.

**ELECTRONIC COMPUTERS: Principles and Applications**

Edited by T. E. Ivall. 25s. By post 26s.

**MATERIAL HANDLING IN WORKS STORES. Second Edition. The Fork-Lift Truck and Pallet System**

L. J. Hoefkens. 18s. By post 19s.

**PRINCIPLES OF MASS AND FLOW PRODUCTION**

Frank G. Woollard, M.B.E., M.I. Mech.E., M.I.Prod.E., M.S.A.E. 25s. By post 26s. 4d.

**PRODUCTION ENGINEERING: Practical Methods of Production Planning and Control**

J. S. Murphy, A.I.I.A. 12s. 6d. By post 13s. 5d.

*Obtainable from all booksellers or direct from*

**THE PUBLISHING DEPT.**
**DORSET HOUSE**
**STAMFORD ST., LONDON, S.E.1**

loading, etc., and wheels carried on swan-necks with pivoted arms for easy unloading, etc.

**LABELLER**
**Ge. J. Meyer Manufacturing Co., Wisconsin.—U.K.805074.**

A glue-coated labelling device dealing with 300 bottles per minute in multiple batches or groups.

**TRACK REPLACEMENT**
**R. Przibu & W. Wasche, of Germany.—U.K. 805075.**

Old rail bed stacked on wagons and new lifted in over it via a bridge frame so that train replaces track as it moves on.

**BELT DRIVE**
**Nitos G.m.b.H., of Dusseldorf.—U.K.805121.**

A conveyor belt drive which switches itself off when slip occurs or if the belt breaks, by means of hydraulic control with a speed-responsive roller.

**PEANUT SEPARATION**
**National Research Development Corporation, of London.—U.K.805224.**

Improvement on patent 748547 with a conveyorized gyrophon separator from haulm and rubbish. Plant carried with dangling gyrophons which are hit by pairs of rotary beaters of increasing power along path.

**ROPE SLINGS**
**J. F. Archer, St. Cloud, France.—U.K.805264.**

Crane load slings, rope, cable or chain type—made with light easily operated hook support which resists turning and gives even tension.

**LIFT STACKER**
**Vereinigte Glazstoff Fabriken A.G., of Wuppertal. —U.K.805351.**

A whole stack of parcels raised from the horizontal to vertical.

**WINDER CONTROL**
**British Thomson Houston, of Aldwych.—U.K. 805382.**

A safety device for mine cage winders, etc., to prevent a driver using excess speed near the end of run.

**LOAD HANDLER**
**J. McCloskey, of Londonderry.—U.K.805397.**

Fire-surrounds and similar arched objects carried by a wheeled frame having an arch support and parallel side bars.

**TELESCOPIC CRANE**
**P. J. Pingon, of Annecy.—U.K.805398.**

Transportable crane with telescopic mast and swinging jib, hinged at its centre.

**LIFT TRUCK**
**Yale & Towne Manufacturing Co., New York, 17. —U.K.805429.**

Pivoted to give easy load positioning in narrow aisles.

**CONVEYORIZED FEED**
**Cliff Vale Engineering Works, Ltd., of Stoke.— U.K.805433.**

Vehicles and containers filled to constant depth with a weighing conveyor feed which automatically controls the rate of traverse.

**CHAIN CONVEYOR**
**Fisher & Ludlow, Ltd., of Birmingham.—U.K. 805449.**

Forged links and plates used with simple form of roller guide.

**EXTENSIBLE CONVEYOR**
**Joy Manufacturing Co., of Pittsburgh.—U.K. 805462.**

Portable mine conveyor which is extensible but avoids slack in the belt at all times.

**LABEL APPLICATOR**
**Rose Bros., Ltd., Gainsborough.—U.K.805481.**

Bottle tops labelled automatically, somewhat as per patent 783090.

**CURVED ESCALATORS**
**M. Hefti, of Switzerland.—U.K.805580.**

An endless platform chain supported on circular frames with roller spindles at corners of isosceles triangles.

**LIFT GRAB**
**Welding Industries, Ltd., of Bristol.—U.K.805615.**

Block or box lift grabs have a pincer pair of fulcrumed levers giving gripping jaws.

**CONVEYOR CONTROL**
**Aktiebolaget Broderne Herrmann, of Stockholm. —U.K.805717.**

Control for sealed bottles on belts—with a magnetic check for presence of metal closure caps using a rotating stop, magnetically operated. Can be applied to conveyors for other purposes.

**CARGO NET**
**J. Jackson, of New Cross.—U.K.805760.**

Polygonal net with inter-connected bearer wires round sides, and easy replacement of any worn portion, cheaply.

**JIB CRANES**
**Clyde Crane & Booth, Ltd., of Gateshead.—U.K. 805892.**

Luffing under positive control with hydraulic piston, using a valveless pump giving reduced shaft stress.

**PNEUMATIC TUBE**
**Lamson Engineering Co., Ltd., of Willesden Junction.—U.K.805893.**

Pneumatic tube carriers with drop tube using double valves to reduce noise and improve efficiency of conveyance.

**SAFETY HOIST**
**Duff Norton Co., of Pittsburgh.—U.K.805898.**

An oscillating lever-operated cha hoist, with a lock roller operating lever travels excessively fast dur lowering.

**AIR CONVEYOR**
**Aktiebolaget Westin & Backlund., of Stockh —U.K.805956.**

Granule transport by air conveyor, foundry sand, giving reduced wear i pipe—using spiral air jets to give a stati ary surface-protecting layer.

**TRACK PACKER**
**F. Plasser & J. Theurer, of Vienna.—U.K.805**

Articulated vibrating tools for r ballast packing—with dampers to redu noise and wear or complexity, having t damper of one to co-operate with limiti vibration range of another.

**CRANE LIMITER**
**B.T.H., Ltd., of London.—U.K.805973.**

Collision preventer for travelling cran on common track—using a resistant w along track contacted by crane, w A.C. voltage.

**HOIST**
**Euclid Crane & Hoist Co., of Cleveland.—U 805979.**

A self-contained hoist with housing drum, motor, and gears, with a sim drive series.

**COLLAPSIBLE CONTAINER**
**Bibby & Baron, Ltd., of Bury.—U.K.806054.**

Braced and pivoted extensible corn supports with a base accepting lift tru forks and having canvas walls.

**SHIP STOWAGE**
**A. G. Weser, of Bremen.—U.K.806098.**

Ship hold design with fixed horizont decks taking containers on rollers, with lift giving movement across from o space to another.

**CONVEYORIZED SPRAYING**
**Daimler Benz A.G., of Stuttgart.—U.K.806765.**

Electrostatic spray painting and l quering of car bodies, etc., by sprays a electrodes moved over fixed paths gantries as the cars pass under, b limited so that they do not interfere getting too close to each other.

**STUB FEED**
**Molins Machine Co., Ltd., Deptford.— 807404.**

Improvement on patent 737329 drum feed of two filter tips at a ti spaced apart, on to a moving web paper, to become two joined cigarettes.

**OIL TANKS**
**Uddeholms Aktiebolag, of Sweden.—U.K.80**

Tank holds for oils, etc., cleaned heavy solvent vapours heated by st e.g. trichlorethylene; cheap and quic